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### THE STUDY OF PERIPHERAL VASCULAR DISEASE WITH RADIOACTIVE ISOTOPES — PART I

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THE objective measurement of blood flow has interested innumerable investigators. Many methods while crude, have contributed to our understanding of the circulation. With the development of more exact instruments for such evaluation, the appraisal of circulatory disturbance has become more critical. These studies not only supplement clinical evaluation of the patient, but permit a more objective evaluation of symptoms, circulatory insufficiency, and results of various forms of therapy.

Investigation of circulatory physiology by instruments has previously been concerned with alterations in skin temperatures, changes in the volume of the extremity determined by the rate and volume of blood flow as measured by the plethysmograph, and dimensional pulsation of mass as determined by the oscillogmeter. These observations, while of value reveal little in regard to the adequacy of the circulation in maintaining normal metabolism in the tissue of the extremity.

In man the flow of blood in the extremities is largely concerned with two factors: (1) the metabolic demands of the tissues and (2) the regulation of body temperature. Since separation

rate requirements of both are to be satisfied it would be suspected that the mechanism of their individual accomplishment would be different. The effective circulation in the muscles of the extremities is dependent upon the flow of blood through the capillaries. In this manner the metabolic demands of the tissues are supplied and the waste products are removed.

Temperature regulation, on the other hand, is basically dependent upon variations in rate and volume of blood flow through the superficial channel. Succquet and Harpuder described the neurovascular glomus in man occurring chiefly in the distal extremities. These structures effect arteriovenous anastomoses by permitting anastomosing between the terminal arteries and the veins of the extremities. When these anastomoses open an increase in the skin temperature results. Harpuder and others have shown that when blood is shunted through such arteriovenous channels a deprivation of blood flow through the nutrient capillaries results and tissue metabolism may be adversely affected. Therefore a rise in skin surface temperature is not an indication of an increase in the nutritional efficiency of the circulation in a part. Similarly changes in volume of the extremity as measured by the plethysmograph are to be expected with the opening of the

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arteriovenous shunts. Other methods which are concerned with observation of changes in the blood flow in the skin have similar limitations.

Blumgart and Weiss in 1927 utilized radioactive substances in the study of the velocity of blood flow. Their method consisted of injecting an active deposit of radon into the antecubital vein of one arm and detecting its arrival in the opposite arm with a shielded cloud chamber. The radioactive substance used in these studies was radium B and its products in equilibrium. Although it rapidly decayed with a half life of 26 minutes the residuum persisting with disintegration was radium D which is also a radioactive isotope of lead with a half life of 22 years. This isotope is deposited in bone and produces a prolonged radiation effect.

With the availability of other radioactive isotopes which are more satisfactory for use as tracers additional methods for the study of the circulation have been developed. Smith and Quimby Musson (11, 12) and others have used sodium 24 as a tracer in evaluating circulatory diseases of the extremities. Sodium 24 possesses many characteristics which make it particularly suitable for such studies. It has a short half life (14.8 hours) and is not selectively absorbed by any tissues. It is relatively rapidly excreted and is nontoxic to tissues. Its freedom from long lived radioactive contaminants and its radiation spectrum make it harmless when used in small amounts. The quantity used in these studies resulted in a radiation to the body of considerably less than 1 roentgen. With the method employed the radiation effect was even less significant. The emissions from the radioactive sodium consist of hard beta and gamma rays. The gamma rays are easily detected and recorded by electronic equipment placed outside the body.

#### ELECTRONIC APPARATUS

For this investigation it was necessary to design an instrument which would permit accurate evaluation of radioactive tracers in studies of the circulation. Quantitative measurement of the radiation from sodium 24 in the tissues was made with an apparatus employing Geiger Mueller tubes which operate an electromechanical system to record auto-

matically and continuously the counts as detected by each tube (Fig. 1).

The Geiger Mueller tube, its quenching circuit and a cathode-follower amplifier are encased in a lead cylinder (Fig. 2). The thickness of lead eliminates about 50 per cent of the radiation from sodium 24 directed at the counter. Although this would not be satisfactory for taking counts in the presence of strong extraneous or scatter radiation, little difficulty was encountered in these investigations. The gamma radiation is admitted to the Geiger Mueller tube through a window formed by removal of a portion of the lead wall. This aperture is covered by a thin aluminum shield. The detector is therefore close to the source of the radiation, resulting in a high rate of count from the area.

With this equipment it is possible to operate four counting circuits simultaneously. These can be used to record counts from one, two or three locations, a remaining circuit being used to record background and scatter radiation. The advantages of such a multiple system in circulatory investigations are evident, but would be offset by the confusion of taking data if an automatic recording system were not employed.

Pulses from a Geiger Mueller tube are fed into a Lifschutz (9, 10) scaling circuit which accepts and "stores up" 32 counts before recycling. A special electronic circuit<sup>1</sup> translates the total number of counts accumulated by a scaler into a current which activates the pen of the mechanical recorder. Figure 3 shows the record that is made using this system. The steps in the figure indicate single counts, while each peak indicates every thirty-second count. At increasing rates where the individual counts disappear, interpolation of the number of counts is made possible by pre-adjustment of the translating circuit to give a deflection of one chart unit per count. At still higher rates, the inertia of the pen makes full swings impossible. At such rates individual counts are of no consequence. Each peak on the chart then indicates the reception of 32 counts. It can be seen that instantaneous changes in counting rates are indicated clearly by a definite change in the slope of the mounting curve. Thus the time at which radioactive material reaches a Geiger Mueller detector can be determined to the second.

A method employing electronic integrating circuits driving graphic pen recorders was tested but several weaknesses of this system proved it to be unsuitable for this study.

Four detectors containing Geiger Mueller tubes are connected by flexible cables to a control panel on the wall of the examining room. From this point the cables extend through an electrical conduit to an adjoining room in which the recording circuits, amplifiers and power supplies are located. The injection

Designed by R. H. Rohrer, Assistant Professor of Electrical Engineering, Emory University and W. B. Miller, Jr., Electronics Consultant for the Department of Surgery. This circuit is described in an article "A Method of Automatically Recording Slow Random Counts," to be published.



Fig. 1. Electromechanical apparatus used for automatically recording impulses received from the Geiger Mueller tubes.

time of the sodium is indicated on the record by means of a foot switch in the examining room.

#### METHOD

Radioactive sodium carbonate is received from the pile at Oak Ridge Tennessee. The mass obtained weighs 0.3 gram and is rated 35,110 milliroentgens of gamma radiation per hour at 24 inches from source of gamma radiation. This material is converted into sodium chloride by the addition of hydrochloric acid. Neutralization is effected by titration with sodium hydroxide. The resulting sodium chloride solution is evaporated to dryness and

is redissolved in pyrogen free distilled water, and sterilized by autoclave. Dilutions of the material are made depending upon the proposed method of utilization.

Two methods of study were employed one, described by Smith and Qumby (12) involves the 'build up' of radioactive sodium in the tissues of the extremities following its intravenous injection in the arm. The second is a relative flow determination based on the rate of disappearance of radioactive sodium when injected intramuscularly, as suggested by Kety. It is obvious that the first method depends not only upon the flow of blood to

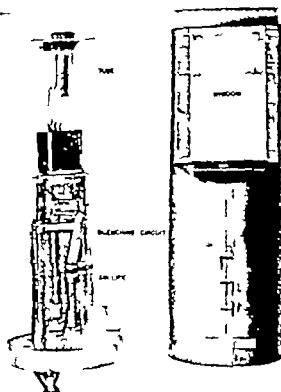


Fig. 2. The detector unit for reception of impulses from the radioactive sodium in the tissues.

the part but also upon the diffusion of the sodium chloride from the vessel into extravascular spaces. The second method is concerned with the mobilization of the sodium which has been injected into the muscle and

its removal from extravascular spaces by the effective circulating blood.

*Method I Intravenous injection of radioactive sodium.* The patient was placed upon a tilt table in a room in which the temperature was constantly controlled at 78 degrees F. The legs were elevated at an angle of 35 degrees (Fig. 4). A detector was placed posterior to each gastrocnemius muscle and at the ball of each foot. Prior to administration of radioactive solution the background count from cosmic rays and other extraneous radiation was recorded by the equipment.

Five cubic centimeters of the prepared solution containing one to two hundred microcuries of radioactive sodium was rapidly injected intravenously in the antecubital vein. The time and duration of injection was recorded. The syringe was removed from the room immediately following injection of the solution.

The circulation time to the leg was determined by the sudden rapid increase in the rate of count (Fig. 3). The circulation time to the foot could not be accurately determined in all instances due to a gradual increase in concentration of sodium at this point. This increased concentration resulting from the establishment of an equilibrium of the isotope between the intravascular and extravascular spaces was recorded over a period of 30 to 45 minutes.

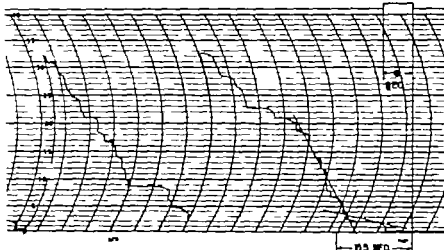


Fig. 3. Chart as recorded by the electronic apparatus. Single counts are indicated by the horizontal lines. Vertically curved lines represent intervals of 5 seconds. The marker indicates the time and duration of injection of the radioactive sodium intravenously.

Ninety individuals were studied by this method. Sixty of these had no demonstrable vascular disease. The curves plotted from their record formed an average pattern (Fig 5). The persons observed, both male and female, varied markedly in build, muscular development, height, weight, age, obesity, and skeletal size. The amount of radioactive sodium injected was recorded. It was found that an unsatisfactory build up curve resulted if less than 80 microcuries was injected. The variation between curves depended more upon the amount of sodium injected than upon any of the above factors. Therefore, in subsequent observations following the injection of drugs, or operation upon the vascular or sympathetic nervous systems, an identical amount of sodium was employed for comparative results.<sup>1</sup>

With this method of study, the random radiation from various portions of the body imposed an exceedingly difficult factor, and a marked increase in background count for each tube necessitated extensive shielding of the Geiger Mueller detectors.

**Method II The injection of radioactive sodium into the muscle.** Utilizing the same apparatus, studies were made following the injection of sodium directly into the gastrocnemius muscle. The solution was diluted so

Miss Mary H. Atkins was technician for this project.



Fig 4. Position of patient on tilt table with legs elevated. Detector units are placed at the site of injection of the radioactive sodium.

that each cubic centimeter contained 100 microcuries. The patient was placed either in a horizontal position or with the extremities

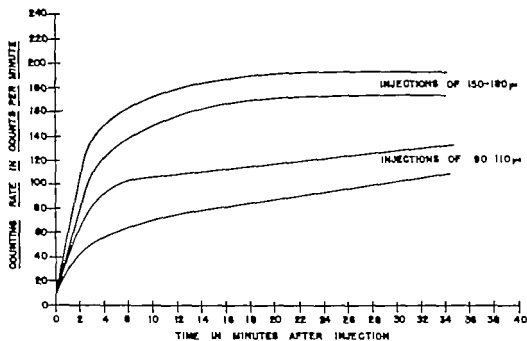


Fig 5. Buildup curves in the tissues of the extremity following the intravenous injection of radioactive sodium chloride in normal individuals.

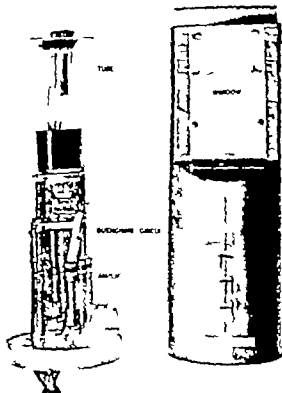


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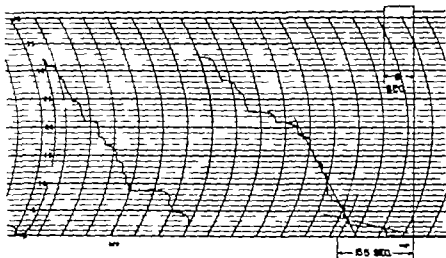


Fig. 3 Chart as recorded by the electronic apparatus. Single counts are indicated by the horizontal lines. Vertically curved lines represent intervals of 1/5 seconds. The marker indicates the time and duration of injection of the radioactive sodium intravenously.

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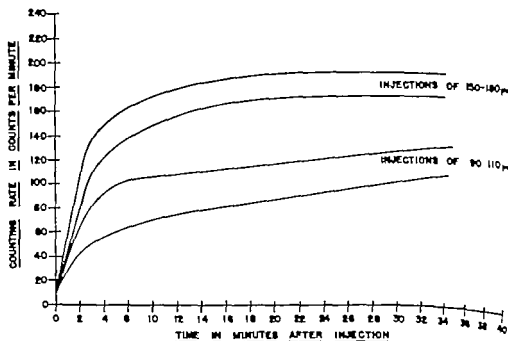


Fig 5. Buildup curves in the tissues of the extremity following the intravenous injection of radioactive sodium chloride in normal individuals.

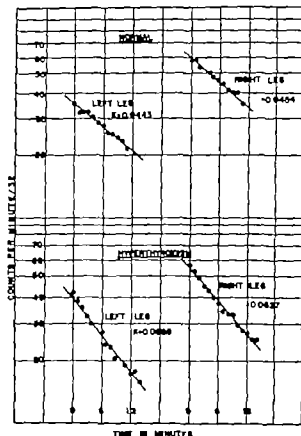


Fig 6. Rate of disappearance of radioactive sodium when injected intramuscularly. Increase in rate of disappearance is indicated by vertical inclination of the line.

elevated and with a detector posterior to the superior portion of each gastrocnemius muscle. A third counter was placed at a short distance from the subject to record background radiation.

A volume of 0.2 cubic centimeter of this solution containing approximately 20 microcuries of sodium 24 was injected into each gastrocnemius muscle. In this study the exact amount of radioactive material injected was of no significance nor was it necessary to inject an identical amount into each calf muscle since the rate of disappearance as evidenced by the decrease in counting rate was the factor to be determined. The patient was constantly observed to insure the immobility of the extremities.

Following injection the recording apparatus was operated for a period of 12 minutes prior to any alteration in the conditions of the

experiment. After the initial or control run various procedures could then be carried out, such as application of a tourniquet, the administration of drugs, the performance of sympathetic blocks, etc. After the procedure was performed the subject was returned to the original position and an additional 12 minute run was made to determine the effect of the therapy on the circulation of the extremities.

Since the amount of sodium injected into the muscle was small no difficulty was encountered as a result of radiation from the opposite extremity or from other parts of the body. Similarly following the mobilization of the sodium into the vascular system and its distribution throughout the body the amount of sodium returning to the extremity through arterial channels was so low that background radiation was not increased.

It is apparent that this method of injecting the sodium directly into the muscle and recording its subsequent removal by the effective circulating blood permits an objective evaluation of the effective blood flow through the nutrient capillaries. While such a determination alone does not allow an exact estimation of blood flow per given muscle mass at this time values are obtained which will permit accurate comparison.

#### DISCUSSION

In both of these methods it was found desirable to elevate the extremity approximately 35 degrees above the horizontal. A stress factor was thus imposed which accentuated the degree of vascular insufficiency. Elevation in the normal individuals produced no changes in the disappearance rate. It has long been appreciated that pallor of the extremity on elevation is one of the simplest tests for vascular insufficiency. Buerger, Brooks, Homans, and others have emphasized that the rapidity with which color returns to the digits of the elevated extremity upon compression indicates vascular sufficiency.

By the intravenous injection of radioactive sodium the recording of its arrival time in the extremities and the subsequent build up of the sodium in the extravascular spaces (method I) the circulation time to the extremities can be accurately determined.

The variations in the circulation time to the extremities found in normal individuals is so wide as to render these results valueless in the diagnosis of circulatory disorders. The arrival of the radioactive material at the part and the subsequent increase in concentration is dependent upon many uncontrollable factors. A measurement is not necessarily being made of the presence of the sodium in the larger arteries but more accurately of that which has escaped into the extravascular fluids.

Through accurate standardization of the quantity of radioactive sodium administered for repeated determinations, comparative data can be obtained on the rate of increase in sodium concentration in the tissues of the extremities. This rate of increase is to a degree proportionate to the volume of blood flow to the extremity. An accurate determination of actual muscle blood flow as differentiated from flow to the various other tissues cannot be determined by this method however. It also has a disadvantage in that it does not immediately reflect changes in the state of circulation in the extremity following the injection of drugs, therapeutic procedures, alterations in position of the extremity or the utilization of mechanical devices which are devised to improve the blood flow.

With injection of radioactive sodium directly into the muscle and the measurement of its rate of disappearance (method II) it is believed that a valuable method of determining the relative effective blood flow to the muscles has been obtained. It is apparent that the rapidity of removal of the sodium from the muscle depends upon the volume of blood flow.

When the results of this method are plotted on semilogarithmic paper with the number of counts per minute plotted on the ordinate and the time on the abscissa, a linear expression of the rate of disappearance of the sodium from the muscle is obtained (Fig 6). The inclination of this line will remain unchanged while the conditions of this experiment are not altered. If the removal of sodium is prevented by the application of an arterial tourniquet above the site of injection the line will become horizontal (Fig 7). As the rate in which the sodium is removed from the muscle increases

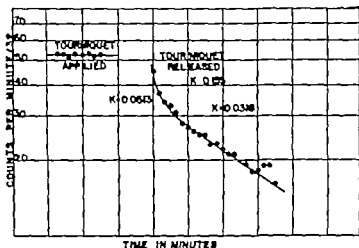


Fig 7. Application of tourniquet prevents removal of radioactive sodium as represented by a horizontal line. Following release of tourniquet the resulting hyperemia removes the sodium more rapidly than normal with a more vertical line being obtained. Equilibrium is established as indicated.

the line will tend to become vertical. After removal of the tourniquet hyperemia results in a more rapid removal of sodium, the normal rate being resumed only after disappearance of the period of hyperemia.

It is believed by Kety that a logarithmic expression of the slope of the line is valid for comparative studies. This expression or 'K' factor is the natural logarithm of the slope of the line and is determined by the equation

$$K = \frac{\log C_1 - \log C_2}{4.343 (T_2 - T_1)}$$

$C_1$  = counting rate at time  $T_1$

$C_2$  = counting rate at time  $T_2$

This latter method has been utilized in 115 individuals both normal and with vascular disease. It has been used in normal individuals to evaluate the effect of certain drugs and other measures reputedly effective in enhancing the circulation in the extremities. Similarly it has been used in the evaluation of patients with vascular disease and their response to therapy. These observations are to be reported at a later date.

#### SUMMARY

1 Two methods for the use of radioactive sodium 24 in the investigation of circulatory physiology of the extremities are compared and discussed.

2 The apparatus is described in detail.



3 The results of one of the methods used in a series of normal individuals are evaluated (The results of the other method are to be published later)

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# OBSERVATIONS ON PRODUCTION OF PERICARDIAL ADHESIONS AND LIGATION OF CORONARY ARTERIES

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**C**LINICAL and laboratory investigation directed toward surgical establishment of collateral circulation to myocardium was pioneered by Claude S Beck (1-7). Three general methods have been used. O Shaughnessy (16) brought an omental graft to the heart from the abdominal cavity through an incision in the diaphragm. Beck (5) used transplants of pectoral muscle. Several authors (10, 11, 13, 14, 16, 17) have produced adhesions between myocardium, pericardium and epicardial fat believing that this procedure might offer a feasible method of approach.

It has been assumed that if anastomoses can be established between vessels of the pericardium and those of the myocardium, augmented circulation would occur that would partially alleviate anoxia of coronary insufficiency. Moritz and associates (14) using injections of colloidal lamp black have shown that extracardiac anastomoses of branches of the coronary artery are increased by pericardial adhesions. O Shaughnessy (18) also demonstrated that vascular connections will develop between vessels of myocardium and adherent or adjacent structures. They used histological and injection studies.

Irritating substances have been applied to the epicardium or injected into the pericardial sac during operation to produce adhesions (21). Materials usually employed (20, 23) have been inconsistently effective or have produced pleural effusion, foreign body granulomatous reaction or damage to the heart. Work by Heimberger indicates that certain detergents would produce adhesions with minimal side effects. Further studies have been undertaken to evaluate materials for production of adhesions and also function of the heart after adhesions. Rats, dogs and one hog were used.

## EXPERIMENTS

For convenience experimental studies will be described in three groups: group I formation of adhesions, group II effect of adhesions, group III effect of adhesions with coronary occlusion.

### GROUP I FORMATION OF ADHESIONS

*Method.* The materials to be tested were introduced into the pericardial sac of white rats through thoracotomy wounds. Operations were performed positive pressure ether anesthesia and aseptic surgical technique were used. Six substances commonly employed by others and reported effective for production of pericardial adhesions were injected into the pericardial sac of 42 white rats. Also various dilutions of 13 detergents were similarly injected into the pericardial sac of 94 rats. As a control, saline alone was injected into the pericardial sac of 10 rats. Also a 5 per cent solution of monoethanolamine oleate was introduced into the pericardial sac of one hog by means of parasternal injections without thoracotomy.

*Observations.* Autopsies on the control series of rats sacrificed 14 to 25 days after operation and injection of normal saline revealed no adhesions. Substances usually employed by others and listed in Table I produced adhesions inconsistently. Three of them, talc, lycopodium and asbestos produced foreign body reaction (granulation) and one talc produced pleural effusion. Among the 13 detergents used (Table II), 9 produced damage to the heart and occasionally death even in dilutions of 2.5 per cent. Three did not produce adhesions. Adhesions involving at least one-third of the pericardium were produced by 10 detergents used. Foreign body reaction was not produced by detergents and soaps but some caused pericardial or pleural effusion. Ubiquitous adhesions with good vascularity were formed in the hog (Fig. 1).



Fig. Subacute adhesions in dog's heart 35 days after injection of monoethanolamine into the pericardial sac. Above the thickened vessels pericardium are seen well developed cysts 5 to 60 micra in diameter fibrosts, and light infiltration of plasma cells and leucocytes.

Of the materials employed for injection monoethanolamine oleate in a 5 per cent solution seemed to be the most efficacious and the least toxic. It was therefore employed to produce adhesions in the rats and dogs used for subsequent experiments.

#### GROUP II EFFECT OF ADHESIONS

Possible effects of adhesions were studied by means of physical efficiency tests in rats and venous pressures and electrocardiograms in dogs. Adhesions were produced in the rats used for these experiments by intrapericardial injection of 0.2 cubic centimeter quantities of monoethanolamine oleate and in the dog by

TABLE I — PRODUCTION OF PERICARDIAL ADHESIONS WITH MISCELLANEOUS AGENTS

Sclerosing agent	No. of rats	Deaths due to agent	Adhesions	Granulation	Effusion
Talc			3	7	
Lycopodium				5	
Invert sugar	6				
Glycerine					
Sucrose					
Asbestos	4		3	3	

TABLE II — PRODUCTION OF PERICARDIAL ADHESIONS WITH SOAPS AND DETERGENTS

Sclerosing agent	No. of rats	Deaths due to agent	Adhesions	Granulation	Effusion
Trisethanolamine lauryl sulfonate	5	5			
Sodium lauryl sulfate	6		3		
Sodium alkyl methyl tartrate	5				
Sodium perfluoride	6		3		
Dreem	6		4		3
Sodium oleate	8	3	3		
Tricure of green soap					
Sodium stearate sulfate	5		3		
Lauryl dimethyl benzyl ammonium chloride	5	5			
Sodium lauryl sulfonate		9	3		
Sodium C <sub>12</sub> alkyl benzene sulfonate	6		4		
Sodium salt of coconut oil					
Monoethanolamine oleate					

injections of 5 cubic centimeters. Relative physical efficiency was tested in rats by forced swimming with 15 grain weights tied to the tail. All animals were sacrificed and examined post mortem after the period of tests for gross and microscopic study of the adhesions.

**Observations** Table III summarizes the effects of pericardial adhesions upon physical efficiency of rats, as determined by the swimming test. There was no significant change of swimming time after formation of adhesions. In Table IV observations on the effect of adhesions upon venous pressure of dogs are tabulated. There was little change either during the first month or up to 4 months. The electrocardiogram of dogs failed to show evidence of constrictive pericarditis, although in one instance 4 months following the formation of adhesions some decrease in amplitude was observed.

All animals were sacrificed after the test periods to determine whether evidences of altered circulation were present. None showed evidence of chronic passive congestion. The morphologic changes following pericardial injection of monoethanolamine oleate in the rat and the dog varied chronologically into three stages.

TABLE III — EFFECT OF PERICARDIAL ADHESIONS UPON PHYSICAL EFFICIENCY OF RATS

Rat	Swimming time prior to injection—seconds	Swimming time after adhesion formation—seconds
	85	05
	00	11
3	70	85
4		90
5	05	05
6	3	05
7	85	90
8	5	06
9	05	
	80	75
Average	91.5	95.6

1 *Acute* The first stage lasting 7 to 10 days was characterized by presence of fibrin polymorphonuclear leucocytes and round cells on the epicardial and pericardial surfaces. Although little effusion was observed in rats approximately 10 to 15 cubic centimeters of fluid was often found in the pericardial cavity of dogs. Evidence of fibrosis or of vessel proliferation was not found during this stage.

2 *Subacute* The subacute phase lasted about 10 to 24 days in the dog and rat and was present at about 35 days in the hog. It was characterized by gradual disappearance of fibrin and development of light fibrous connective tissue joining the two serous surfaces (Fig 2). Most interesting and important was the development of communicating blood vessels which appeared at this time. These vessels were well formed, dilated capillaries for the most part, with lumina about 12 to 60 micra in diameter and full of blood. Some of the vessels had a thin outer coating representing adventitia and possibly muscularis. Most however were smaller.

3 *Chronic* In the third the chronic stage little was seen except a moderately thickened, adherent, fibrotic pericardium with little cellularity or vascularization.

#### GROUP III EFFECT OF ADHESIONS AND CORONARY OCCLUSION

*Methods* Ligation of the anterior descending branch of the left coronary artery was performed through a thoracotomy incision using

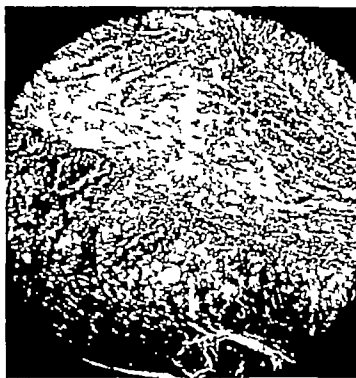


Fig 2 Rat heart with subacute vascular adhesions. Above the intact myocardium is seen the vascular thickened epicardium-pericardium adhesions with well formed capillaries. The subacute inflammatory process seen on the outer surface of the pericardium is the result of leakage that occurred in many of these rats after injection.

No 6-0 silk in the rat and No 3-0 silk in the dog. Swimming time in the rat and electrocardiograms and venous pressures in the dogs were employed to test the effects of ligation alone and of ligation and adhesions. The effect of coronary occlusion produced prior to or up to 1 month following formation of pericardial adhesions was studied in rats. A series of dogs

TABLE IV — EFFECT OF ADHESIONS ON VENOUS PRESSURE

Preoperative (cm H <sub>2</sub> O)	Less than month postoperative (cm H <sub>2</sub> O)	More than month postoperative (cm H <sub>2</sub> O)
24		27
6		
		26
26		29
5	8	14
24	26	
	3	
6	9	
8		
9	26	
Average 20	3	4



Fig. 1. Rat heart injected in the left ventricle one month after ligation of the left coronary artery.

was also studied in which coronary ligation was performed alone or following the formation of pericardial adhesions.

**Observations.** The extent of decrease of swimming time following coronary ligation is illustrated in Table V. It is evident that a significant decrease in relative physical efficiency occurred after ligation. Infarcts developed in the myocardium of the left ventricle of each rat (Fig. 1).

In a series of 8 rats ligation of the left coronary artery was followed within a few days by

TABLE V.—A COMPARISON OF SWIMMING TIMES BEFORE AND AFTER CORONARY LIGATION.

Rat	Time before ligation—seconds	Time one month after ligation—seconds
1	65	95
2	70	—
3	80	—
4	30	30
5	1	40
6	1	11
7	95	5
8	85	77
Average	65	75

\*The four rats having large infarcts.

TABLE VI.—EFFECT OF PERICARDIAL ADHESIONS PRODUCED WITHIN A FEW DAYS AFTER CORONARY LIGATION.

Rat	Swimming time before ligation—seconds	Swimming one month after ligation and pericardial adhesions—seconds
1	65	95
2	1	1
3	80	5
4	1	1
5	—	70
6	—	100
Average	—	—

injection of the pericardial sac and production of adhesions. Swimming times were obtained 1 month later; results are summarized in Table VI. In 6 rats adhesions were produced 1 month after coronary ligation. Swimming times were obtained before ligation 1 month later before re-injection to produce adhesions and 1 month after adhesions (Table VII).

The venous pressures of 2 dogs to be treated by ligation of their coronary arteries averaged 16.7 centimeters of water before operation. One and 2 months after ligation their pressures averaged 15.0 centimeters of water. Ligation of the left coronary artery was performed in 4 dogs 10 to 24 days after injection of the pericardial sac during the stage described above as subacute or having vascular

TABLE VII.—EFFECT OF PERICARDIAL ADHESIONS PRODUCED ONE MONTH AFTER CORONARY LIGATION.

Rat	Swimming time before ligation—seconds	Swimming one month after ligation—seconds	Swimming one month after ligation and pericardial adhesions—seconds
1	1	35	1
2	7	30	70
3	65	40	30
4	80	45	5
5	—	30	16
Average	—	30	7

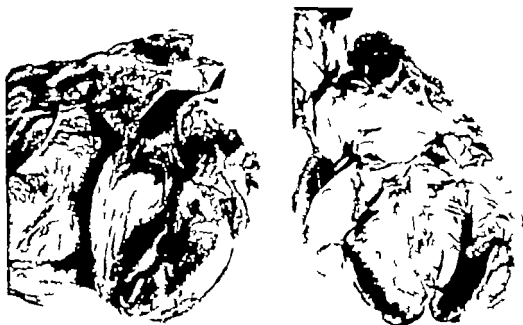


Fig 4 Myocardial infarction in the dog heart produced, a left in the presence of the early subacute stage of pericardial adhesions, and, b in the absence of pericardial adhesions.

adhesions. This effected a change of venous pressure from an average of 16.7 centimeters before ligation to 24.5 centimeters during the first several days afterward.

Electrocardiograms obtained before and after coronary artery ligation in each of the above two groups of experiments revealed changes of pattern characteristic of anterior infarction.

Autopsy revealed large infarcts in the wall of the left ventricle of each of the above dogs. Typical infarcts are presented in Figure 4. The microscopic appearance of these infarctions and of adhesions produced 4 weeks or more before autopsy are presented by a representative section (Fig 5).

#### OBSERVATIONS

Experiments have indicated that monoethanolamine oleate in 5 per cent solution when injected into the pericardial sac of the rat, dog or hog produces good adhesions without undesirable side effects. Adhesions are fibrinous for 7 to 10 days then fibrous and avascular another 10 to 35 days and subsequently fibrous and avascular.

Adhesions themselves produce no change in relative physical efficiency of rats as determined by swimming times or by venous pres-

ures or electrocardiograms of dogs during 1 to 4 months of observation. Autopsies revealed no evidence of constrictive pericarditis or of passive congestion.

Ligation of the anterior descending branch of the left coronary artery in rats produced



Fig 5 Avascular fibrotic pericardium characteristic of the chronic stage of pericarditis in the dog. Scarring of the myocardium; evidence of an old infarction, is seen above. At 4 o'clock is a bit of suture material.

infarction of the muscle of the heart wall with reduction of relative physical efficiency as evidenced by decreased swimming times. In jection of the pericardial sac a few days after ligation did not change this decrease of swimming time. Adhesions produced a month or more after coronary ligation did not produce significant increase of swimming time. The slight increase shown in column 3 of Table VII could be explained by gradual improvement in function of the heart after the ligation and would probably occur even though the adhesions were not present.

Ligation of the coronary artery of dogs during the subacute or vascular stage of adhesions was followed by typical infarction and by some heart failure as judged by increase of venous pressure.

Pericardial adhesions evidently neither alleviate the diminished function following coronary ligation nor hasten recovery. Neither do they effect a significant reduction in the size of myocardial infarcts. There were however fewer changes in the postligation electrocardiograms of those dogs having pericardial adhesions before ligation.

#### CONCLUSIONS

1. These studies have not yielded evidence to support treatment of patients with myocardial ischemia by production of pericardial sac adhesions.

2. Blood vessels that appear 7 to 10 days after production of adhesions are replaced within a month by avascular scar tissue.

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# PRINCIPLES OLD AND NEW OF RESECTION OF THE COLON FOR CARCINOMA

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SINCE the first successful resection and anastomosis of the bowel for carcinoma by Reybord in 1832 the problem of removal of a segment of bowel and restitution of continuity has been a continuing challenge to all abdominal surgeons. It shares with all other surgical procedures the improvement in results following the many advances in the care of patients that have occurred in recent years, tending I believe more nearly to standardize the surgical treatment of cancer of the colon than has been possible before.

I am intentionally avoiding a statistical approach to this problem but rather have chosen to review the more important contributions through the application of which the writer has developed his present concept of the management of these cases. I am intentionally limiting this discussion to resection of the colon for cancer because this involves the dual problem of proper treatment of the cancer and the technical aspect of resection and anastomosis. I am excluding the lower segment of the large bowel, which has been treated by combined abdominoperineal excision or by anterior excision with a permanent colostomy.

## LYMPHATIC SPREAD

As I see segments of bowel resected for carcinoma which have been brought to the laboratory I cannot but conclude that in many instances the surgeon has been so concerned with the technical aspect of re-establishing continuity that the primary problem of curing the patient of his cancer has been neglected.

The primary objective of an operation for cancer is complete eradication of the disease. If complete resection is to be accomplished it must be foremost in the surgeon's mind and the operation planned must have this as the primary objective. To plan an adequate resection presupposes an understanding of the vas-

cular supply to, and lymphatic drainage from the colon with particular reference to the amount of tissue which is to be removed if the patient is to have the optimum opportunity of cure.

In 1909 Jamieson and Dobson, after careful study of prepared specimens presented an excellent description of lymph drainage from the various segments of the colon. They called attention to the line of first defense, the so-called paracolic glands located along the arcades on either side of the lesion and of the concentration of the drainage from these into the intermediate glands situated between the arcades and the origins of the colic and sigmoidal vessels, all of which are removed in an adequate surgical excision (Fig 1). On a basis of this study, they suggested the amount of tissue which should be removed in order to offer the proper protection from lesions in the several segments of the bowel (Figs 2a, b, and c).

The recent work of Gilchrist and David on the lymphatics of the rectum and of Collier, Kay, and MacIntyre on the colon would seem to have definitely established certain additional facts. (1) By the time the patient is operated upon, more than half of the lesions (rectum 69 per cent, colon 60.8 per cent) will have metastasized to the regional nodes. (2) Metastases may occur without gross changes in the nodes be unnoticed by the surgeon and demonstrated by the pathologist only after the application of special techniques. (3) While the normal flow of lymph coincides with the direction of venous return, an alteration of flow will result and metastases may occur in a retrograde direction if a given lymph channel is blocked. (4) The size of the local lesion is no criterion as to the presence or absence of nodal metastases.

The practical application of these studies to amount of tissue to be removed at operation will be discussed later.



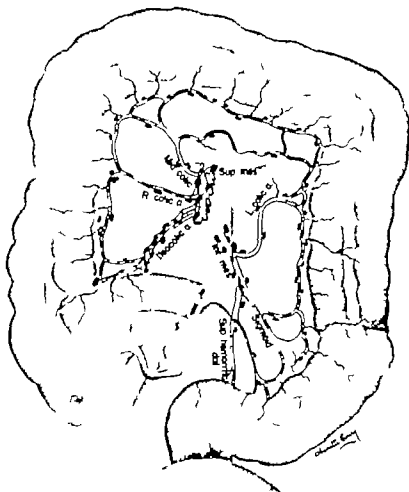


Fig. Showing arterial supply and distribution of more important lymph nodes. The celiac nodes on the wall of the bowel are considered of lesser importance and are not shown.

#### DEVELOPMENT OF TECHNIQUE OF RESECTION AND ANASTOMOSIS

The observations by Lanfrank in 1396 and Travers in 1812 that healing of the intestines to the parietal peritoneum and to each other came through the agglutination of the serosal surfaces, followed in 1826 by Lambert's description of a method of suture which would hold in apposition the serosal surfaces of two segments of bowel to be united represent the earliest contributions to intestinal resection. Little of significance followed until 1892 when two contributions of great importance appeared in the literature—the introduction of the anastomosis button by John B. Murphy

and the description by Oscar Bloch of an entirely new approach to the problem by the extra abdominal removal of a segment of bowel. Murphy in describing his anastomosis button said: "If means can be devised—1st to hold the surfaces in contact 2nd while in contact to produce a speedy and permanent adhesion of the surfaces 3d to keep an opening sufficiently large for the free passage of intestinal contents 4th to produce as a result a cicatrix that will not contract to any great extent and by the contraction produce complete or partial obstruction—we will have overcome the great barriers remaining between us and ideal success in intestinal surgery."

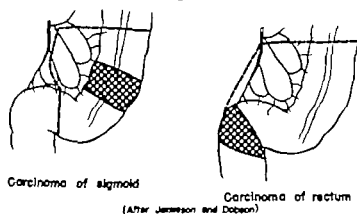
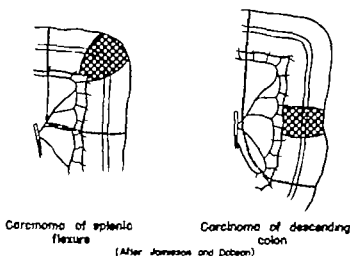
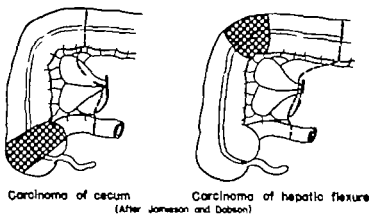


Fig. 2. a, Segments of bowel to be removed for carcinoma of cecum, left, and hepatic flexure, right, as suggested by Jamieson and Dobson. b, Segments of bowel to be removed for carcinoma of splenic flexure, left, and descending colon right, as suggested by Jamieson and Dobson. c, Segments of bowel to be removed for carcinoma of sigmoid, left, and rectosigmoid, right, as suggested by Jamieson and Dobson.

In that same year Bloch in Norway, discouraged by the high mortality following primary resection of the bowel for cancer (he gives reports from various clinics showing mortality rates of from 47 to 59 per cent), conceived an operation whereby peritonitis

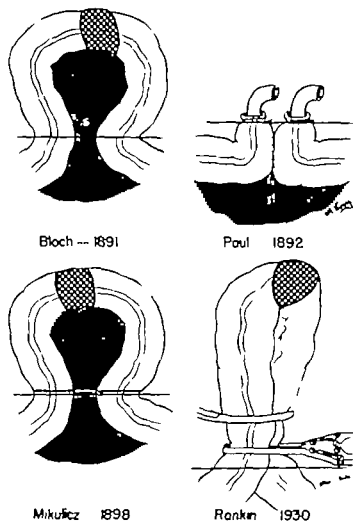


Fig. 3. Schematic representation of operations described by Bloch, Paul, Mikulicz, and Rankin.

could be avoided by doing the actual resection of the bowel outside of the abdominal cavity. A short (6 cm.) incision was made just above and parallel to the inguinal ligament; a long loop of sigmoid with the carcinoma at its apex was withdrawn through this wound and anchored to the wound at either end; an opening was made in the mesentery well away from the growth through a relatively avascular area where there were no enlarged nodes and a glass spatula put through this (Fig. 3). Two sutures were placed on either side of the bowel approximating the afferent and efferent loops. A rubber tube was placed in the proximal segment for relief of the obstruction. One month later the bowel and mesentery were divided and an attempt was made to do an extra-abdominal anastomosis between the two ends. This anastomosis failed. The patient was discharged 6 weeks later, remained well, gained in health, and returned after 2½ months.

(about 5½ months following the original operation) At this time an end to-end closure was done in the wound. The anastomosed segment of bowel was then freed and replaced in the peritoneal cavity. The patient had a relatively uneventful convalescence was discharged and died at a later time of metastatic cancer of the liver.

Three years later Mr F T Paul surgeon to the Liverpool Infirmary apparently unaware of the work of Bloch describes 7 cases from which he evolved a logical finished concept of the management of cancer of the large bowel. The presentation of these cases is an excellent example of orderly thinking and warrants brief comment. His first case—a woman of 49 with obstruction and vomiting due to cancer of the sigmoid was operated upon a very favorable growth removed and a difficult anastomosis carried out by invagination on the decalcified bone. Death the night of operation was thought to be due to a long difficult operation as well as to the slight leakage which was found at postmortem. The next case—a woman of 47 entered with complete obstruction due to a large carcinoma of the sigmoid. A right lumbar colostomy was done to relieve the obstruction. Ten days later the growth was resected. The operation was difficult and the patient's condition too poor to warrant suture of the ends of the bowel so that they were brought out through the wound as had been done on previous occasions by a number of other surgeons. This patient died at the end of 36 hours and Paul makes the following note. "I consider that the loss of this case was due chiefly to a want of appreciation of the profound and prolonged effect of a serious attack of intestinal obstruction partly to the absence of sufficient technical skill." His third case—a 47 year old woman with a cancer of the cecum also had a resection and what he considered a very satisfactory anastomosis by the bone tube method. This patient also died of peritonitis, which he thought might have been due to restriction of too much blood supply. And in discussing this death he makes the following note "The sloughing of the cut end of the colon would probably have taken place with any mode of approximation but had it been outside in

stead of inside the peritoneal cavity the small area of gangrene would have done no harm. His fourth case—a woman of 60 ill with acute obstruction of 9 days duration was operated upon through a left inguinal incision. The sigmoid with the obstructing lesion was withdrawn through the wound the bowel was clamped a portion of the bowel containing the growth was excised and a glass intestinal drainage tube was sutured into each end of the bowel. The dressing was then applied and the proximal end of bowel permitted to drain into a basin. This patient made an uneventful convalescence and died 2 years later at which time postmortem examination failed to reveal any evidence of recurrent disease. This operation was done in May 1892 Mr Paul noted.

One might conclude that when the excision was not too extensive and the ends of the bowel brought out correctly it might be undertaken with comparatively little danger to life. Case 5—a patient of 38 without marked obstruction was operated upon for a carcinoma of the descending colon. The bowel was freed from the splenic to the sigmoidal flexure the mesentery carefully tied ligated and divided the bowels brought out through the wound and the glass tubes inserted. This patient too made an uneventful convalescence. Paul was not content however to permit this patient to go through life with a permanent colostomy and 5 weeks after the original operation an attempt at closure of the colostomy was carried out. The patient died of peritonitis 4 days later. Paul in reviewing this case expresses his disappointment at having evolved a method of resecting a tumor safely only to have the patient die in attempting to avoid a permanent colostomy. He then makes the following interesting statement.

"There remained however to be tried the old plan of restoring continuity by Dupuytren's enterotome to which very little risk is attached. If such a method could be perfectly successful when the spur was accidentally formed by nature how much more ought it to be so when a spur was deliberately constructed with the object of being subsequently safely removed? I have therefore, brought out and determined to put in practice the following method of operating in the next case. First, excise the strictured portion of bowel as in the last 2 cases then suture together the cut edges of the mesentery and the adjacent sides of the two ends of the colon in

such a manner that they would adhere together for about 3 inches, in the position of two barrels of a double barreled gun. If this succeeded the spur might be demolished without the slightest risk of peritonitis and to such an extent as to insure a free passage and easy closing of the artificial anus (Fig 3)

His next case done according to this concept had the growth removed and the colostomy successfully closed. In the final case reported the patient died following operation before the anastomosis was carried out. Death was due to uremia, as proved by autopsy. There was no peritonitis and the two parallel limbs of bowel which he had sutured were well healed. It is of interest that Paul's final conclusions formed on a basis of these experiences were

"When the patient is in good condition the abdomen not distended the tumor small and the proximal end of the bowel not greatly hypertrophied I advise immediate approximation by Murphy's button method. But when the opposite of these conditions prevails I strongly urge that the ends of the bowel should be brought out in the manner explained and illustrated and I feel sure though I have been unfortunate in the sort of cases I have had to deal with that this method of bringing out the ends is much safer than any other plan of immediate approximation all statistics notwithstanding

It need only be added that Mikulicz in 1903 referring to Bloch's work but making no reference to that of Paul described and strongly advocated the exteriorization type of operation. His plan was to mobilize the bowel divide the mesentery to include removal of regional nodes bring the loop through the wound close the abdominal wall apply a dressing, and remove the growth in 12 to 48 hours or immediately (Fig 3). A tube was placed in the proximal segment. He did much to popularize this procedure and to bring it before the English speaking world particularly the surgeons of this country through his writing and particularly through its inclusion in a system of surgery published in this country in 1904 (2).

This procedure was brought to its highest state of perfection by Rankin in his article Obstructive Resection published in 1930. Without question the development and utilization of the principles involved in these procedures represent the greatest single contribu-

tion to the safety of resection of the large bowel that has been made.

The early frequent wound recurrences due to inadequate operation, which often followed the exteriorization procedures and the long period of disability stimulated surgeons to continue their quest for safer methods of primary anastomosis. In the gradual evolution of this method, certain serious hazards were recognized. Of greatest significance was the rôle of obstruction so well expressed by Paul in his article and stressed so much by the many writers in this country. It is impossible to know to whom credit should go for insistence upon proper attention to the obstructed bowel and particularly to the development of the importance of relief of obstruction through proximal decompression. Again it is of interest that Paul in 1891 did a right lumbar colostomy as a preliminary procedure in a patient with acute obstruction upon whom a diagnosis of cancer of the left colon had been made (Case 2 above). Jones Cheever Rankin, Whipple (19) Bevan, and many others advocated and repeatedly stressed the importance of proximal decompression until it was accepted by most surgeons of experience as an essential part of resection with primary anastomosis. Proximal decompression for resection of the colon probably reached its highest state of development with the use of the Miller Abbott tube as described by Whipple (20).

In the earlier days of direct anastomosis outstanding contributions were made by the development of simple and safe methods whereby anastomosis could be carried out with closed bowel thus avoiding the dangers of contamination from the open ends of the transected intestine. Of the many methods described the writer has preferred that of Parker and Kerr whose anastomosis utilized the principle of a basting stitch rather than instruments. It has proved to be simple, useful and safe.

Stone and McLanahan in 1939 stressing the importance of the closed anastomosis recognized the diminishing need for proximal decompression and may well have ushered in the modern era of safe intestinal anastomosis without its use except in selected cases with obstruction.

TABLE L.—TYPES OF OPERATION AND MORTALITY RATES—1932-1941

	Number	Deaths	Mortality rate %
Anastomosis with proximal decompression	40	6	15
Anastomosis without proximal decompression			0
Obstructive resection	3		0
Right colectomy one stage	5	5	100
Right colectomy two stages	20		5
Totals	90	0	

## PRINCIPLES GOVERNING SAFE ANASTOMOSIS

Along with the development of safer methods of suture and the acceptance of proximal decompression certain basic principles were stressed as essential or of great importance in the completion of a safe and proper operation. Thus Bevan in 1920 was governed by three basic principles: (1) proper selection of incision; (2) free mobilization of the bowel in relation to the growth; and (3) the use of a lateral rather than end-to-end anastomosis. The writer during his long association with D. F. Jones constantly heard stressed the importance of three fundamental principles in any intestinal anastomosis: (1) adequate blood supply; (2) avoidance of excessive intra-abdominal pressure through proximal decompression; (3) avoidance of any tension at the suture line.

Improved methods of anesthesia and a better understanding of the many aspects of patient care have resulted in such improvement in results following all major surgical procedures that we may now revise our thinking in relation to intestinal resection bringing together experiences of the past with the developments of the present.

We might then present what we consider to be the essential basic principles for resection of the colon for cancer:

1. Proper preparation of the patient for operation.
2. Optimum exposure of the segment of colon to be excised.
3. Adequate mobilization of bowel.
4. Adequate cancer operation.
5. Free blood supply to both segments.
6. Avoidance of tension on suture line.
7. Proximal complete colostomy if adequacy of suture line or blood supply is in doubt.

*Preparation of the patient.* The name of Rankin more than any other one surgeon is associated with careful and adequate preoperative preparation of any patient who is to be operated upon for cancer of the large bowel. Only in recent years, however, has the real importance of this become apparent to all surgeons. We customarily require from 5 to 10 days, or more of hospital care in preparation of a patient for resection. Just how long proper preparation will take is dependent upon a number of factors relating to the degree of obstruction and the general condition of the patient. Rather than state the time involved one might better state the objectives to be obtained. Unless repeated hemorrhage or some other complication prevents every effort should be made to have the patient go to operation with a deflated empty well prepared bowel. He should be well nourished, with a serum protein level and hemoglobin within normal limits, and have had an adequate or excess vitamin intake. In the absence of more than a mild degree of obstruction this is accomplished by the use of an active cathartic on the afternoon of admission (our preference is for castor oil but any active cathartic is satisfactory) sulfasuxidine or sulfathalidine (the former if there is any degree of obstruction) for a minimum of 5 days; a low residue diet containing from 100 to 125 grams of protein daily; the use of some potent polyvitamin in excess of the normal needs; and blood transfusions to bring the hemoglobin to within normal limits. The use of the scout film to determine the amount of material in the bowel proximal to the lesion is very helpful. It has been our experience that patients with mild to moderate obstruction will empty out their bowels in a completely satisfactory way following the use of sulfasuxidine and small divided doses of a saline cathartic if sufficient time is allowed. In those patients who cannot be otherwise adequately prepared, particularly in those patients with complete obstruction, some form of proximal decompression is necessary. In the completely and acutely obstructed patients, it is our policy to do a cecostomy under novocaine suturing a half inch rubber tube into the distended cecum by several infolding sutures. If after release of the acute

obstruction the bowel cannot be satisfactorily prepared either through spontaneous restoration of bowel activity or the use of irrigations through the cecostomy tube with the Miller Abbott tube as suggested by Millett a transverse colostomy is done. This is placed to the right of midline if the splenic flexure is to be mobilized otherwise, in or to the left of midline. As will be noted proximal surgical decompression has been used in only a small proportion of cases in the recent years (Table II).

We now use the Miller Abbott tube in preparation for operation only on certain indications. If the patient has a large, full abdomen or a tendency to slight distention the Miller Abbott tube is started 48 hours before time of operation in the hope that it may be well into the lower small bowel at the time of resection. This not only provides proximal decompression but the fluting of the bowel on the tube markedly increases the freedom with which the operative procedure can be carried out. In those cases in which the Miller Abbott tube is not to be used the Levin tube is inserted into the stomach the afternoon before operation and placed on suction in order to eliminate all swallowed air from the intestinal tract for a period of 12 to 18 hours before the time of operation. This insures a deflated stomach and does lessen the amount of gas that will be found in the small bowel.

**Incision.** Experience with various types of incisions in patients who have been operated upon has convinced me that the only important consideration in the selection of an incision is the amount of exposure which is given throughout all aspects of the proposed operation. The incision most frequently used for resections in the right half and the left half of the colon is a long right or left rectus muscle splitting incision. This is particularly useful on the left where as will be later shown most resections involve mobilization of the splenic flexure above and an anastomosis which may frequently involve working with the distal sigmoid in the lower abdomen. The transverse incision gives excellent exposure for a resection and anastomosis of the transverse colon. In general an incision placed parallel to the long axis of the bowel to be resected

TABLE II — TYPES OF OPERATION AND MORTALITY RATES—1942-1947

	Number	Deaths	Mortality rat %
Anastomosis with proximal decompression.	12	2	16.6
Anastomosis without proximal decompression.	67	4	5.9
Obstructive resection	1	0	0.0
Right colectomy one stage	43	0	0.0
Right colectomy two stages	6	1	16.6
Total operations	129	7	5.4
Total resections with primary anastomosis	110	4	3.6

will afford optimum exposure of that particular segment.

**Adequate mobilization of bowel.** We have become increasingly convinced that Bevan's insistence upon adequate mobilization of the bowel is one of the most important factors in resection of the left colon. Except for the occasional lesion which we find at the apex of a long loop of sigmoid or for the lesion in the lower sigmoid it is our policy to mobilize the splenic flexure and a portion of the transverse colon in all cases. If the incision is properly placed and of sufficient length if the dissection is started in the region of the sigmoid or descending colon and carried up around the splenic flexure, mobilization of the splenic flexure (unless there is a large tumor in that area) is not difficult nor is it hazardous. Not only is this necessary in order to do an adequate operation for many of the lesions in the left colon but the increased mobility of the upper and lower segments of bowel makes it possible to bring the ends to be joined into the wound outside of the abdomen, insuring freedom of action and complete absence of tension on the line of sutures. It is our feeling that this procedure has contributed more to the safety and to the ease of left colectomy than has any other single maneuver.

**Adequate cancer operation.** In Figures 4 and 5 are shown the segments of bowel which we believe should be removed for cancers located in the various segments of the colon in order to give the patient the best chance of permanent cure. It is recognized that this is a schematic presentation and that abnormalities in blood supply or physical set up will frequently make impossible the carrying out of what we believe to be the theoretically correct procedure. It

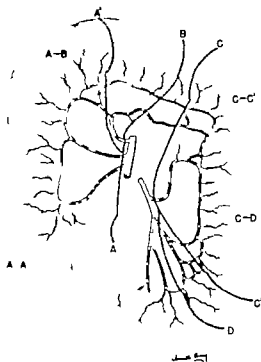


Fig. 4. Schematic representation of segments of bowel and mesentery which should be removed for carcinoma of rectum, I A hepatic flexure, I B splenic flexure C-C' and descending colon, C D

is nevertheless surprising how frequently one can approach the ideal if that is the major objective of the surgeon particularly if the concept of complete mobilization is accepted. A very free anastomosis between the vessels and presumably also the lymphatics above the level supplied by the superior hemorrhoidal artery makes it desirable at least on the theoretical basis, to remove a long segment of normal bowel and mesentery below the margin of the growth as well as above. We prefer a minimum of 3 inches of normal bowel and accompanying arcade of vessels and lymphatics on either side of the lesion with inclusion of the lymphatic drainage to as high a level on the primary branches of the superior or inferior mesenteric arteries as local conditions will permit.

**Blood supply** There can be no question but that the importance which Jones placed upon

adequate blood supply cannot be overestimated. Primary suture in the absence of a completely adequate blood supply will result in leakage and unless there is proximal diversion of the fecal stream severe sepsis or death may occur. Normally and probably in many instances the free collateral exchange between the various branches of superior and inferior mesenteric arteries will insure adequate supply over a long segment of bowel even if primary branches are divided so long as the arches are left intact. Nevertheless, surgeons and students of the blood supply to the large bowel are aware of the many anomalies which exist and it is our judgment that assurance of adequate blood supply is not to be based upon a knowledge of what the anatomy should be but upon an actual visualization of pulsating or bleeding vessels at the margins of divided bowel to be anastomosed. If we cannot see actual pulsating vessels so situated as to insure blood supply to the cut end it is our policy to transect intentionally a small vessel before a clamp is applied in order to visualize free arterial bleeding. Only under these conditions can one be assured that anastomosis can be safely carried out.

**Avoidance of tension** Too often surgeons forget that sutures merely represent a method of holding in approximation the segments of bowel to be joined. They are not a means of bringing together two segments under tension and temporarily keeping them in place. Any two ends of bowel which are to be united must lie in easy approximation and be completely free from tension.

**Complimentary transverse colostomy in selected cases** Those surgeons who have had wide experience with the abdominoperineal excision of the rectum are aware of the tremendous variation in the amount of blood carried to the rectum through the middle hemorrhoidal arteries. Many times these vessels are cut during the course of the dissection without the necessity of applying ligatures. Other times they are large freely bleeding vessels supplying a large amount of blood to the segment in question. If therefore the superior hemorrhoidal vessels have been divided as they should be divided for lesions whose lymphatic drainage accompanies these

vessels, it will frequently happen that the blood supply to the upper rectum to which the sigmoid must be joined will be questionable or it may be that under this circumstance there has been difficulty in properly placing the sutures and the surgeon may not have the complete confidence in the technical phase of the anastomosis that he would like. Under these conditions it is our feeling that a loop of transverse colon should be brought out through a separate incision in the upper abdomen and the fecal stream completely diverted from the line of anastomosis. If such a procedure is carried out it is then essential that before closure of the colostomy the line of anastomosis be carefully examined by means of barium enema to determine whether or not there is a leakage around the suture line. If such leakage does occur and it not infrequently will the closing of the colostomy must be postponed until healing is complete and in any of these cases we have seen up to the present time healing has occurred spontaneously in 1 to 3 months.

#### TECHNICAL CONSIDERATION

**Right colon** We have never used the exteriorization operation on the right colon. In the occasional cases in which patients cannot be properly prepared for a one stage procedure we have used preliminary ileotransverse colostomy followed in 16 to 21 days by resection. In this type of case, we prefer lateral anastomosis in continuity to transection of the ileum. For many years following the teaching of D. F. Jones we used the lateral anastomosis in our one stage procedures. This is probably the simplest and safest type of anastomosis that can be done. If the blind ends are short they do not give symptoms and the functional results are completely satisfactory. More recently, we have been doing an open end to-end anastomosis. Although the functional result is no better than when the lateral anastomosis was used the anatomical result is superior and there is only one suture line to put in. If the lateral anastomosis is used the medial side of the mesentery is closed before the anastomosis is carried out. If the end to-end junction is employed it is easier to do the anastomosis first closing the mesentery after the anasto-

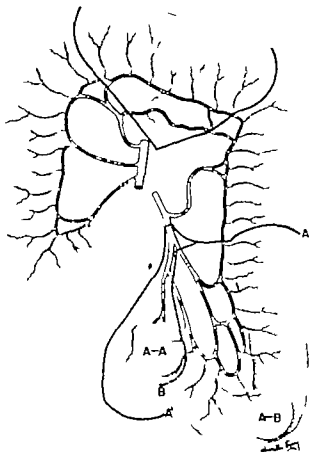


Fig. 5 Schematic representation of bowel and mesentery to be removed in carcinoma of transverse colon at apex of long mid-loop of sigmoid, A-A and lower sigmoid or recto-sigmoid, A-B.

mosis is completed. The lower portion of the right gutter is closed in all cases, but only rarely can it be closed throughout its entire length. Drainage is not employed unless there is persistent oozing or an abscess cavity has been broken into. Proper drainage is then instituted into the retroperitoneal area through the right flank.

**Midtransverse and left colon** Wide acceptance of the exteriorization operations was probably the greatest single factor in increasing the safety of resection of the left colon. It has made possible safe intestinal resection in the hands of experienced and less experienced surgeons. However there are definite disadvantages in this type of operation and with the present development of patient care and technical surgery I feel certain that these operations will rapidly diminish in popularity. I personally have done but one in the last 6 years. I feel concerned at times lest our res-



TABLE III.—RESECTIONS WITH PRIMARY ANASTOMOSIS CAUSES OF DEATH—1942-1947

Operation	Age	Cause of death	Comment
Resection of transverse colon	78	Ket. Leuemia	Palliative operation—extensive local disease
Resection of recto-sigmoid and resection of sigmoid	78	Sadder—a cause found (autopsy)	
Resection of sigmoid		Peritonitis (clinical)	Palliative operation—extensive local disease
Resection of sigmoid		P. (mucous embolism) (autopsy)	Was ready for double—local—killed by peritonitis

dent staff at the Massachusetts General Hospital not know the technique of this procedure as it is now so rarely used in that institution.

The operation of choice for the writer in a lesion at or beyond midtransverse colon is an adequate removal of the bowel and mesentery with a direct end-to-end anastomosis. My own preference is for a closed type of anastomosis,<sup>1</sup> using the Parker Kerr technique. We prefer the basting stitch to the use of instruments since in our hands it is more flexible is always available and can be used lower in the pelvis than instruments. We have personally had no difficulty in the formation of a diaphragm or with any other form of obstruction at the site of the anastomosis. Care is taken not to narrow the diameter of the bowel during the placing of sutures and to be sure that the diaphragm is adequately broken down after the basting stitches are removed. We use a No. 1 plain catgut for the basting stitches, a continuous No. 000 chromic catgut suture for the inside and interrupted No. 70 cotton for the outside layers. When possible the suture line is protected by means of omental tabs or by means of omentum. Drainage is not used unless there is some specific indication as suggested above. The mesentery is always carefully closed medially but when the left colon is completely mobilized the remaining bowel falls back into the raw area in the left gutter and no attempt is made to close this with peritoneum.

There is an increasing trend toward use of

<sup>1</sup>The closed anastomosis is not suitable method after resection for diverticulitis, nor do we use it in anastomosis of small bowel.

open anastomosis and the recent report of Allen Welch and Donaldson gives support to the safety of this method. It is not the method but the care with which the operation is carried out that is of major importance.

I do not use chemotherapeutic or antibiotic agents locally or systemically. It is my feeling that if the requirements for direct anastomosis have been fulfilled and the operation has been carefully done the anastomosis will function properly, there will be no leakage and there is little danger of peritonitis. If the blood supply is inadequate or if the sutures have not been properly placed there will be leakage and serious results may follow. Bactericidal agents will not compensate for either. I am not convinced that intestinal antiseptics play as important a part in intestinal surgery as does careful preparation of the bowel and of the patient as already discussed. While I do use sulfasuxidine or sulfathalidine in the preparation of the bowel before operation I still consider the bowel contents as actively infectious as though no drug were used. I hold but one thought—restitution of bowel continuity through a carefully done anastomosis independent of any other help.

**Postoperative care.** The postoperative management of these patients is very simple. A transfusion of 500 cubic centimeters of whole blood is usually given on the table during the course of the operation. If there has been undue blood loss during the procedure additional blood is given to replace the loss. The patient is allowed liquids without milk or fruit juices during the early period of healing aware that the line of anastomosis is probably weakest at the end of about 4 or 5 days. On the fifth day milk is allowed in the diet. Following that it is rapidly built up to an adequate diet low in residue. The rectal tube is inserted at frequent intervals to permit the release of any gas which might collect in the rectum. Morphine or pantopon is given freely for any discomfort. Supplementary fluids are given by the parenteral route if the oral intake has not been adequate and it usually is not for the first 3 or 4 days. Vitamins C and B complex group are given intravenously in 5 per cent glucose in distilled water or in saline as the indications may be. One thou-

sand cubic centimeters of 5 per cent amigen or its equivalent in dextrose is given daily for 4 or 5 days. A hematocrit or hemoglobin determination is made 48 hours after operation. If the hemoglobin is below 13 grams per 100 cubic centimeters sufficient blood is given to bring it above this level. If the Levin tube has been used we rarely leave it in place more than 48 hours after operation because of the inability of the patient to utilize fluids taken by mouth with the tube in place. If the Miller Abbott tube has been used and is well down the patient can be given fluids as desired and will utilize them. If the patient tolerates the tube well it is left in place until gas is being passed freely by rectum. If on the other hand, the patient is greatly bothered by the tube, we have no hesitancy in removing it after 24 hours. We do not use sulfasuxidine after operation. In most cases the bowels will move spontaneously by the sixth day, if they do not move by this time, milk of magnesia, 10 cubic centimeters every hour for 3 doses, is given. The patient is usually discharged 10 or 11 days after resection.

### RESULTS

The immediate results following resection of the colon for cancer are given for the past 16 years, the year 1942 being used as the transition year from the earlier to the present methods (Tables I and II). More striking than the drop in mortality rate is the transition from staged operations to resection and primary anastomosis, proximal decompression being reserved for those who were admitted with advanced obstruction or where a difficult anastomosis had been performed low in the pelvis and there was some doubt as to the security of the suture line. The mortality rate of 3.6 per cent for the 110 operations in which a primary anastomosis was done seems to justify a continuance of the present methods.

*Discussion of fatal cases following primary anastomosis (Table III).* The 2 patients who died following resections for extensive local and metastatic disease need no comment. The 78 year old woman, whose sigmoid growth had intussuscepted, who was operated upon with obstructive symptoms and without proper preparation, and for whose death no adequate

cause was found, should probably not have had a primary resection with anastomosis. Better judgment might well have avoided this fatality. The fatal pulmonary embolism occurred in a young woman with a somewhat difficult low anastomosis. Autopsy showed necrosis of a short segment of the suture line which had spontaneously healed by agglutination of the open area to adjacent structures. Quite possibly this local fault contributed to the formation of the fatal thrombus. This represents either a technical error or error in judgment in not recognizing the possible faulty anastomosis and performing a proximal colostomy.

### SUMMARY

Several of the more important contributions to resection and anastomosis of the colon for cancer have been reviewed.

Principles for resection and primary anastomosis are presented.

Results following resection in the decade before 1942 and in subsequent years are given.

The trend toward resection with primary anastomosis is shown and mortality rates given which would seem to justify this change.

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# THE EFFECT OF HEPARIN ON WOUND HEALING

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IN 1940 in this laboratory evidence was presented by controlled experiments that heparin will prevent the reformation of peritoneal adhesions (5). It was postulated that this effect is due to the prevention of the formation of fibrin in the peritoneum into which fibroblasts could grow. If heparin has this effect in the peritoneal healing process, a similar effect might occur in wounds by the prevention of the formation of a fibrin scaffold for fibrosis with resulting delay in the increase of wound strength. Since heparin is used freely in postoperative cases any such result should be known. The work herein reported was interrupted by the war and only recently completed.

Murray in 1938 pointed out that heparin apparently did not inhibit the healing of incisions in blood vessels, although no measurements were made. Bendix studied the effects of heparin on the healing of gastric incisions finding no effect on the fifth postoperative day. Laufman and Heller in 1943 reported no essential difference between the tensile strength of abdominal incisions in dogs receiving heparin postoperatively and a comparable group of control animals. Several investigations have shown an inhibitory effect of heparin on growth of embryonal and tumor tissue in culture media (2, 3, 7).

## METHODS

In these experiments, rabbits were used weighing 5 to 7 pounds. Under nembutal anesthesia and aseptic precautions, a right rectus incision was made. The stomach was brought up into the incision and a segment of the anterior gastric wall grasped with an atraumatic clamp. The anterior gastric wall was incised for a distance of 2.5 to 3.0 centimeters, and the incision was closed with two layers of fine cotton. A Connell stitch was used for the

inner layer and interrupted mattress sutures for the outer. The abdominal incision was then closed in three layers, with three continuous fine cotton sutures—one for the peritoneum and posterior rectus fascia, one for the anterior rectus fascia, and one subcuticular stitch for the subcutaneous tissue and skin.

Two series of animals were followed, one control and one experimental. The operative procedure was identical in all of the animals. All were fed a standard laboratory diet, including green leafy vegetables, and received 100 milligrams of vitamin C subcutaneously each day beginning with the day of operation. The experimental group received  $\frac{1}{2}$  cubic centimeter of heparin<sup>1</sup> intravenously and 1 cubic centimeter subcutaneously immediately after the operative procedure, following which they were given 1 cubic centimeter of heparin subcutaneously every 4 hours until the time of sacrifice for wound testing. It was found that this massive dose of heparin was required to assure continuous and marked prolongation of the coagulation time in the animals from the time of closure of the abdominal wall to the time of wound testing.

Plasma proteins were determined by the micro-Kjeldahl method on each animal preoperatively and at the time of sacrifice.

Groups of animals in each series were sacrificed at intervals of 2 days beginning with the second and ending with the fourteenth postoperative day. The stomach wound was tested by excising the stomach, ligating the orifices, and inflating it with compressed air until rupture occurred either through the wound or in the normal stomach wall. The pressure in millimeters of mercury at the time of rupture and the site of rupture were recorded. One centimeter strips across the abdominal incision including all the layers of the abdominal wall and the contained suture

<sup>1</sup>From Surgical Research Laboratory, University of Virginia Hospital.

cc Toronto units per c.

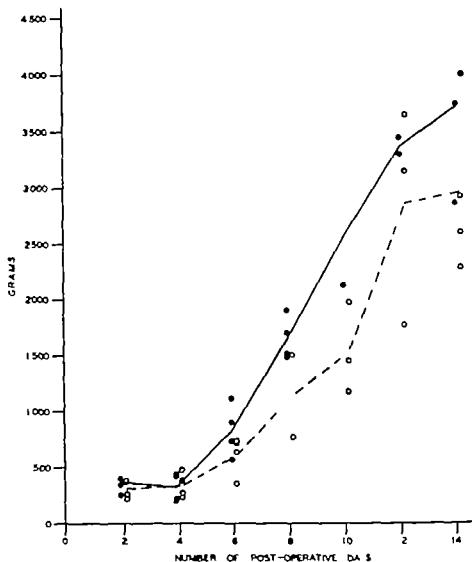


Fig 1 Wound tensile strength, individual and average. Black dot, control average; circle, experimental average.

material, were tested by suspending the strips between two clamps and adding weight at a constant rate until disruption occurred. The disruption weight was recorded in grams. Two or more one centimeter strips from each animal were tested, and the average of these several values was taken as the tensile strength of the wound. Since the continuous sutures were divided at each border of the test strip they pulled out without influencing the breaking strength of the wound. The data obtained were subjected to statistical analysis in the case of the abdominal wounds.

Numerous animals died on the first to fourth postoperative day: 17 out of 40 or 42.5 per cent, in the experimental series and 7 out of 35 or 20 per cent in the control series. In the control series the causes of death were the effect of anesthesia or hemorrhage from

cardiac puncture done to collect preoperative blood samples, while in the experimental series death occurred from these two causes as well as hemorrhage from the gastric wound, although careful hemostasis was carried out. No animals that showed gross evidence of hemorrhage either in the general state of the animal or by pathologic findings were used in the evaluation of wound healing in either the control or experimental series. The control group contained 27 satisfactory animals and the experimental, 23.

#### RESULTS

The tensile strengths of the abdominal wounds (individual and average) for the control and experimental series are shown for each time interval in Figure 1. The average tensile strength of the abdominal wounds of

TABLE I.—GASTRIC INCISIONS

No. days	Control Series		Experimental Series	
	At wound mm Hg	Not at wound mm Hg	At wound mm Hg	Not at wound mm Hg
	66	60	60	60
	45			
	66			
	34			
	30	60	60	54
			33	
			60	
	40		30	
6	7	45	65	
		90	48	
		66	34	
8		64	76	76
		70	64	
		64	60	
		76		
		60		
		80		
		70	86	
			55	
		30	68	
14		7	6	70
		6		
		90		
		67		

the control animals at each interval is 200 to 1 000 grams stronger than that of the corresponding wounds of the experimental animals from the sixth through the fourteenth postoperative day. The individual wounds at each time interval of testing in the heparinized series are in general of lower tensile strength than are those in the control series, although the strongest wounds in the experimental series at each time interval are stronger than the weakest wounds in the corresponding control groups with the exception of the tenth postoperative day.

The results for the gastric incisions are shown in Table I for the control and experimental series. In the control series of 27 animals, there are 14 which ruptured at the gastric incision while 13 ruptured at some point other than the incision. In the experimental series

TABLE II.—PLASMA PROTEINS

Control Series		Time of sacrifice—days postoperation	Experimental Series	
Preoperative gms / 100 cc.	At time of sacrifice gms / 100 cc.		Preoperative gms / 100 cc.	At time of sacrifice gms / 100 cc.
3.65	4.85		4.76	3.68
3.60	4.73		3.97	4.68
3.43	3.5		4.0	3.87
4.58	3.3			
3.46	3.43	4	3.32	3.65
3.5	3.3		3.13	4.93
4.82	3.4		3.74	3.44
3.79	4.83		3.61	3.58
3.33	3.28	6	4.30	4.39
6.13	3.67		3.07	3.4
3.83	4.67		4.75	4.81
3.5	4.03		60	39
3.35	3.33	8		
5	3.43		3.30	3.06
3.48	4.05		6.70	3.08
7.3	4.82			
6.35	6.57			
3.91	6.00		8	6.95
6.13	7.7		6.50	6.00
6.13	6.73		6.7	3.94
6.45	3.63	12	6.46	4.96
6.27	6.16		6.05	4.94
8.37	3.85		6.26	6.41
3.43	3.56		6.35	6.30
3.80	3.7	14	6.04	3.97
3.60	6.05		6.30	3.74
4.90	69		6.83	3.43
3.8	44			
3.8	44	Average	3.78	3

of 22 animals, there were 16 which ruptured at the gastric incision while 6 ruptured at some point other than the incision. In considering the animals at the twelfth and fourteenth day none of the stomachs in the control series ruptured at the incision. However all of the stomachs at the corresponding days in the experimental series, with the exception of 2 in the 14 day group ruptured at the incision.

The values for the plasma proteins, preoperative and at the time of sacrifice of the animals for the control and experimental series are shown in Table II. In the control series, the average preoperative plasma pro-

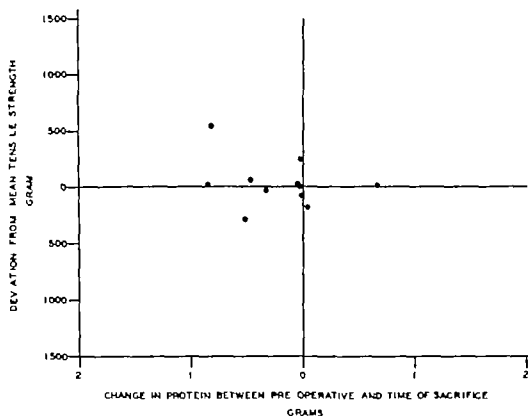


Fig. 2. Control series, relationship of protein to mean wound tensile strength

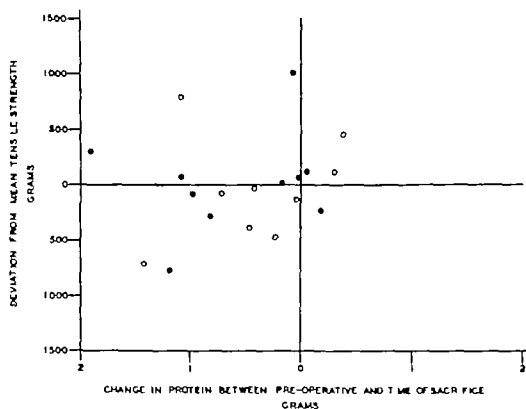


Fig. 3. Experimental series, relationship of protein to mean wound tensile strength.

tein for the whole group is 5.58 grams per 100 cubic centimeters, and at the time of sacrifice 5.44 grams per 100 cubic centimeters whereas in the experimental series the average pre-

operative plasma protein is 5.72 grams per 100 cubic centimeters, and the average protein value at the time of sacrifice was 5.25 grams per 100 cubic centimeters.

## DISCUSSION

In the evaluation of the results when comparing control and experimental series of animals the effect of the factors known to influence wound healing must be considered. It has been repeatedly demonstrated that proteins and vitamin C influence wound healing; therefore, the adequacy of the control of these two factors must be considered in determining the effect of heparin on wound healing.

In this experiment the animals of both series received the same diet and were given excessive amounts of vitamin C parenterally. It was therefore believed that the vitamin C factor was not responsible for possible differences in wound healing between the control and experimental series.

The protein levels in the two series were not so readily controlled because of unmeasured and variable blood loss particularly in heparinized rabbits. In the control series there was an average plasma protein loss between the preoperative period and the time of sacrifice of 0.14 gram per 100 cubic centimeters. In the experimental series there was an average loss of 0.45 gram per 100 cubic centimeters. With the greater average loss of protein in the experimental group of animals, it is important to determine if there is any correlation between protein loss and wound strength in each series of animals. The effects of protein change on wound strength can be represented graphically by plotting wound strength deviation from the mean wound strength for each series of animals against the difference in preoperative and postoperative protein for each animal in the two series. In Figure 2 it is seen that in the control series there is no relationship between change in protein level and wound strength deviation from the mean, since the 18 animals having protein loss were equally divided as to wound strength above and below the mean. This same distribution above and below the mean is found in the animals showing a

gain in protein. In Figure 3 the relationship of the change in plasma protein to wound strength deviation from the mean is shown for each animal in the experimental series. Although a greater number of the animals in the series showed a loss in protein, 8 of them having a loss had wounds of tensile strength above the mean. Therefore, the changes in plasma protein in the control and experimental series did not influence the wound strength in either series to an appreciable degree.

The differences in wound strength found between the control and experimental series is not great, but one of statistical significance on analysis.

Although not statistically controlled the fact that in the experimental series as compared with the control series a larger proportion of stomachs ruptured at the wound instead of through the stomach wall tends to confirm the unfavorable effect of heparin on wound healing as demonstrated in the abdominal wounds.

## CONCLUSIONS

1. In the heparinized series of rabbits, the wound strength, 6 to 14 days after operation is less than in the nonheparinized series. The difference is statistically significant.

2. Twice as many heparinized rabbits died postoperatively before the time of sacrifice as nonheparinized rabbits. This fact introduced a possible selective factor into the experiment.

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# PRESERVATION OF FUNCTION IN CYSTIC AND SCLEROTIC OVARIES

## Report of Sixteen Cases of Single Ovary

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THE function of ovaries embarrassed by cystic and sclerotic disease need not be lost because of the inability to dispose of offending follicles. With a proper understanding of the pathology it is possible to explore these organs and preserve or perhaps even improve their utility. The statement has been made that since cystic follicles are generally distributed throughout the entire ovarian stroma, complete resection of the cysts is impossible without oophorectomy and furthermore would be ineffectual even if accomplished as it is obvious that the original trouble lies beyond the ovary (11). It would seem that if the original trouble was always outside the ovary when polycystic disease exists then both ovaries should be similarly affected, whereas actually one ovary is involved while the other remains clear just as often as both ovaries are attacked.

To prove clinically that such ovaries are amenable to surgical therapy I believed it necessary to demonstrate on single impaired ovaries that they were capable of resuscitation. Then there would be no question of controls or whether one ovary was carrying all the burden when two are present. The opportunity was presented by the overwhelming failure of surgeons to persevere with the many conservative gynecological measures like the extended myomectomy and cystectomy of Bonney (3) and Falk's tubal division for salpingitis which reduce to a minimum the need for removing any part of the internal genitalia, particularly in young women. But as this pernicious and mutilating practice continues unabated, I have taken advantage of it in those instances where one ovary has been left behind to deny that it is impossible to take away all the enlarged follicles without removing the ovary and to sustain the principle that when follicles

obstruct the circulation and innervation especially where these enter the organ the ovary may be given a new start and restored to usefulness after these hindrances are removed. This applies not only to ovaries enlarged by polycystic disease, but more especially to the apparently normal ovary which contains in distinct and inconspicuous threats to its function.

Although the operation has been done on 155 patients only 16 form the basis of this report. They are women who have only one ovary since both tubes and the other ovary had been removed, presumably for pelvic inflammatory disease. At intervals of 1 to 9 years this single remaining ovary became not only inadequate but also disabling forcing these patients to seek relief. Instead of removing the crippled organ an attempt was made to restore its dynamics so that complete castration with its attendant evils could be averted. Its success has surpassed my expectations, and since the therapeutic armamentarium including endocrine and psychiatric therapy was exhausted before surgery was suggested it is logical to presume that the operation was the sole reason for the results obtained and should be applicable with even more benefit when both ovaries are present. This procedure therefore is presented as an other aid in preventing the deplorable and contemptuous treatment of the female genitalia that is still so prevalent and to support the position that in the surgery of the ovary excision should be the last and certainly not the first resource for the gross irregularities so frequently encountered.

The results in the 139 patients with two ovaries have been worthwhile and will be the subject of another report. Of these, 36 were patients with previously diagnosed ovarian disease, while in the remainder the procedure



was part of some other operation which required entering the pelvis. However with the exception of size the pathology differs in no way from that of the 16 cases of this report although in the latter the scars, adhesions, and contractures of the previous operation increased the difficulty of the exploration and intensified the cortical fibrosis.

#### PATHOLOGY

Farre in addition to being the first to describe that important but neglected area of the ovary which he designated as the white line pointed out that an ovary which appears to be normal may indeed have one-third to one half of its volume occupied by what he termed morbid follicles. As he put it "The morbid follicle occurs as a single cyst in the midst of otherwise healthy tissues. Although occupying more than one-third of the entire ovary it scarcely disturbs the even outline of that organ. Its coats are of uniform thickness throughout. There is no attenuation or preparation for dehiscence at any particular spot nor external sign of increased vascularity in one point.

These follicles do not rupture nor do they regress rapidly and thus become an impediment in the mechanism of cyclic activity. But their consequence varies with position and if they happen to be placed near the mesovarian border beneath the thick unyielding cortex of the white line the circulation and innervation are obstructed right where these enter the ovary. The circulation is compressed not only between follicles and the cortex, but also between the follicles themselves thus preventing the formation of a collateral circulation.

This is no rare occurrence. It happened in every one of the 16 cases of this report and in 60 per cent of the ovaries of normal size in the remainder of the series. In fact only one ovary of the 16 was enlarged and that was by a hemorrhagic cyst. This frequency raises the question of whether the normal ovary can be recognized from a casual inspection of its exterior.

The ovary can of course be expanded by multiple cysts or multifollicular and single cysts so huge that the ovary becomes a mere appendage of the tumor. These are not con-

sidered in this discussion as this study is directed more at ovaries which are of normal size and configuration but whose function is impeded by difficulties it cannot overcome. The essential principles of ovarian exploration can be applied to these swollen ovaries with equal benefit and the ovary can be retained as a functioning unit.

Microscopic evidence of circulatory interference inside the ovary has been published elsewhere (9). As none of the ovaries of this series were removed I can add nothing to what already has been described. Continued study of the ovaries taken out by others confirms this picture.

Grossly while the follicles are clearly apparent, pathologists seldom see the true state of affairs. In the living person the line of demarcation at the hilum of the ovary where the vessels make their transition into it is distinctly defined since there is an abundant circulation in the mesovarium which contrasts sharply with that in the ovary below. Moreover there are often extensions of the disease in the mesovarium above which arise from follicle changes that mischance has brought to the ovary just below the white line. It is only by putting the mesovarium under tension while it is still in place that the presence of this scarring above the line can be used to locate a malevolent follicle below it. The intra-ovarian stresses disappear also when the ovary is disconnected from the circulation. What may seem to be a flaccid organ out of the body can have areas of increased pressure when within it that may really be the deranging forces.

These concealed tense follicles can be the source of ovarian pain even when there is no enlargement or evidence of adnexal disease. While this pain usually radiates to the thigh or sacroiliac region it may simulate the symptoms of appendicitis especially in teen-age girls. Failure to detect such follicles are the cause of numberless appendectomies which are succeeded by oophorectomy with its distressing sequelae. It is not unlikely that they play some part in certain cases of dysmenorrhea and intermenstrual discomfort. The favorable and sometimes dramatic results of exploring apparently normal and obviously abnormal ovaries has led me to this conclusion.

A follicle expanding in or near the region of the white line provokes a more intense fibrotic reaction of the cortex there than at the free ovarian border. Corpora albicantia are often found in this area but as pointed out by Allen, maturation of a follicle is not required for them to come into being. The fibrotic processes surrounding these bodies, however tend to contract the ovarian cortex toward them even more than around follicles. In the larger series I found on four occasions definite follicles between the folds of the mesovarium itself. These had the appearance of ovarian follicles but may have been derived from the par-oophoron. The displacement of vessels could be seen easily but as this was taking place in soft tissues it was having little effect on the circulation.

Thus at the white line which is the junction of the peritoneal endothelium with the ovarian epithelium and is literally the life line of the ovary there is greater prospect for adversity. Dissection of this part of the cortex from the stroma beneath is much more difficult than from any other part of the ovary as the two surfaces are held together by strong fibrotic bands through which vessels and nerves must pass. A follicle maturing between these surfaces has less freedom and at the same time excites a more intense cortical reaction here than anywhere else. Nor is this reaction limited to the outline of the follicle. It reaches down over the ovary and up into the mesovarium, in the meantime squeezing the vessels passing through it, not only by contracting but also by occupying the spaces assigned to the blood supply. This is manifested frequently by hypertrophy of the white line which seems to embrace the hilum with a strangling band. If the fibrotic infiltration has not advanced too far engorgement of the ovary will take place when this tight structure is released.

In ovaries enlarged by polycystic masses the white line, or for that matter, the remnant of the ovary itself is so hidden in the whole spread of that structure that it is hard to find. But the white line is quickly revealed if the suspensory ligament is traced down from the uterus as it will lead directly to this line and the ovary no matter how small or indistinct

that may be. The ovary will usually be found so compressed as to be practically useless yet it may contain many cells which while barely subsisting because of the compression are capable of being revived.

#### ETIOLOGY

The removal of one ovary is often justified by the fact that one testicle one kidney or even one lung will do the work of two if too great a burden is not put upon it. The difference in the character of physiological function is, however completely disregarded. Of all the endocrine glands the ovary is the only one which does not maintain the same physical unity continuously. Not only physiological changes of the hormones but variations of physical forces inside the ovary, caused by the incessant rise and decline of follicles, are constantly going on. One ovary is not adapted to the measured beat of the menstrual cycle that normally requires two. There is yet no proof that the ovaries alternate in ovulating but clinical experience provides enough signs and symptoms to indicate that they do. When one carries the burden alone cyclical rotations are taking place with such excessive rapidity that the ovary cannot accommodate them. Hence the ovarian stroma becomes enmeshed in a mass of follicles from which it cannot extricate itself, culminating finally in endocrine inadequacies and discomfort.

The endocrine aspect also must be considered in conjunction with the fluctuating forces inside the ovary. The decrease in total ovarian mass is followed eventually by a decline in the output of estrogen and progesterone which are essential not only for the systemic metabolism, but also for that of the ovary itself. When the demand for either cannot be met the basis for a vicious cycle is prepared since the two hormones reach their greatest magnitude at different times and the activity of one is largely dependent on that of the other.

With the remaining components of the menstrual cycle still operating the single ovary beset by internal physical difficulties and external endocrine stimuli cannot survive for long the struggle to perform its function. Nothing can be expected from endocrine

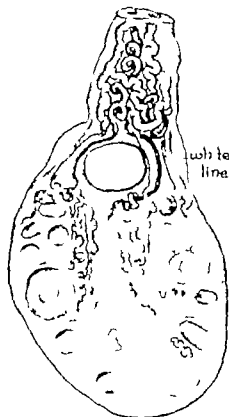


Fig. 4. Diagram illustrating the mechanism of ascula occlusion at the ovarian hilum.

Fig. 5. Cross section of the normal ovary. Note that in the normal ovary the vessels are unhampered, that the maturing follicles are near the surface and that the circulation is able freely to traverse the hilum in both directions.

Fig. 6. A large follicle located right here the vessels enter the ovary. There is no indication on the surface of its presence and it could hardly be discovered by palpation. The vessels are caught between the enlarging follicle and the underlying tunica albuginea. It is doubtful if a collateral circulation can develop with sufficient rapidity to prevent damage to some of the ovarian stroma beneath.

therapy when the changes in the ovary have become firmly established.

There is little actual data on the percentage of women with only one ovary who eventually required the removal of the other, but there is plenty of evidence that this practice has been and still is severely condemned. Caffier reports that two-thirds of a series of women who have had one ovary removed eventually got into further difficulty with the remaining organ. If that statement be true then this series of cases represents only 24 previous operations. The 16 first operations were carried out by different surgeons who were working in as many localities.

Howard A. Kelly, commenting on oophorectomy remarked: "The surgeon must bear in mind that his relationship to his patient is

not dissolved with the successful performance of an operation—and he must decide if the remote sequelae of operative interference may be even more distressing to the patient than the present pains since she might become disabled in most relations of life. Proper surgery depends upon the recognition that what were once considered diseases of the tubes and ovaries are in many instances no diseases at all.

Arthur E. Hertzler was even more eloquent. He said:

"It has always been a mystery to me why surgeons should regard the castration of the human female with indifference even derision. Even now women come to the clinic in droves who have had ovaries removed and were wrecked by it. But fortunately the science of medicine constantly advances. Formerly it was the surgeons who castrated their patients; now it is the roentgenologists.

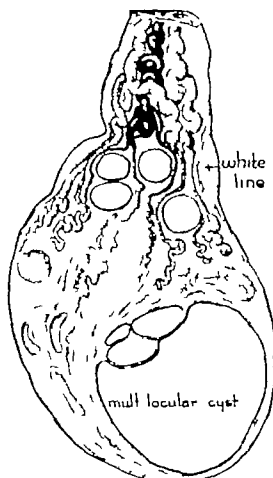


Fig. 3. Multiple small follicles in the ovarian hilum and a large unruptured one at the free border. These larger follicles which are usually emptied by just puncturing them may contain several smaller cysts any one of which can go on to occupy the space thus created. The smaller follicles in the hilum interfere with the circulation not only between the cyst wall and the cortex but also between the follicles themselves. Sometimes these extend along the whole length of the ovary between the white lines.

I will have no more of it. There is not a lesion in this chapter (Involutional States of the Ovary) which can be maintained as pathologic to a degree that justifies removal and none in which the removal of an ovary but makes the last state of the patient worse than the first. The difficulty is due to the attempts to solve problems by detached study. The pathologist describes what he sees, the surgeon in the simplicity of his faith in the infallibility of pathology accepts the symbols of speech literally and cuts. The microscope does not reveal function. The physiological phase of the ovary can be determined only by study of the living. The study of the patient before and after removal of the ovaries is the only way in which one can determine their relation to the well being of the patient. Some of the most intense reactions I have observed occurred in women who had their ovaries removed after the cessation of the menses.

Many more of equal eminence could be quoted, but as I stated little heed is given to

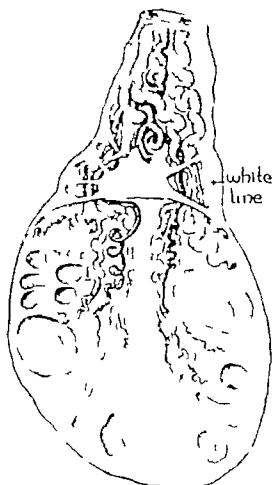


Fig. 4. A corpus albicans in the hilum. The reaction around these is greater than around follicles with clear fluid. Fibrous bands sometimes extending up into the mesovarium can be seen often with the naked eye and the cortex is firmly attached to it. Any combination of these conditions can be present and as there is little likelihood of either the follicles or corpora albicantia regressing in this strategic location, they more or less permanently alter the structural pattern of the ovarian stroma.

their admonitions. Although these men do not tell what happens to the remaining ovary when the other is taken away they imply that the remote effects are disastrous. The reason is that the single ovary becomes structurally incapable of carrying on continuously since it cannot cope with a pace that is too swift and a demand that is too great for its slow moving mechanisms.

The dynamics of ovulation are still obscure. Even though it is a process stimulated by an endocrine synchronism, physical forces play a large rôle in its execution constantly changing the distribution of intraovarian pressures. The idea that during ovulation only one follicle enlarges is denied by Strassman. He stresses the point that several follicles around a focus expand but only one goes on to ovulate.



Fig. 5.



Fig. 6.

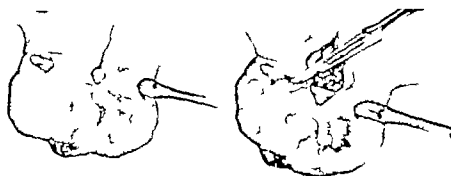


Fig. 7.

Figs. 5 to 7. Technique of ovarian exploration.

Fig. 5. An apparently normal ovary without any sign of trouble within it. However the transparency depicts its follicles and corpus albicans in the hilum with vessels caught between them.

Fig. 6. A short incision is made in either border not quite through the cortex just below the white line. The incision is completed with the end of the small knife while the blade is held parallel to the cortex. The flat of the blade sinks into the stroma separating it from the cortex and the knife is thus accurately placed between these two structures. The knife is then passed across the ovary to the

because a one-sided proliferation of the theca interna of this follicle forms a cone directed

other border overcoming any resistance while the curved end is held against the cortex. A small incision is necessary sometimes to allow the knife to emerge because the ovarian capsule may be too tough for it to come through.

Fig. 7. An incision is made over the knife at the middle of the ovary and is then stretched by a small pointed clamp to open the mesovarium. The use of a knife here would cause too much bleeding. The point of the clamp is placed just beneath the peritoneum of the mesovarium which can then be locked with but little hemorrhage occurring. The cortex is opened along the length of the knife which is withdrawn.

toward the surface of the ovary. This cone, which is wedge-shaped on the cut surface in-



Fig 8

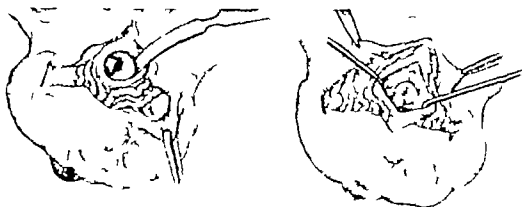


Fig 9

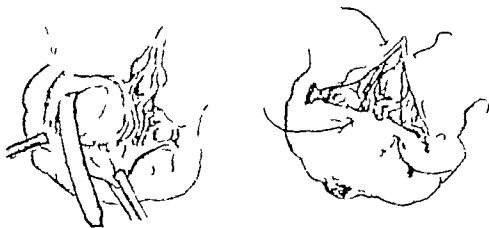


Fig 10

Fig 8 The white line is grasped with Allis clamps and the end of the tonsil knife used to dissect the cortex off the stroma. It should be separated into the mesovarium. If the dissection is done accurately there will be little bleeding. This part of the cortex may then be removed. Follicles which otherwise have escaped detection can easily be palpated with the forefinger. It is not difficult to distinguish a cyst from a corpus albicans. The former feel like soft balls, while the latter are harder and their outline is not as distinct. The corpora are not excised but merely broken up so the ovary can absorb them.

Fig 9. The middle cyst is enucleated. The stroma over

the follicle is separated and the cyst shelled out. Note the two smaller cysts behind it. Puncturing will suffice for these.

Fig 10. The largest follicle is enucleated. No harm is done if it does not come out intact but one must make sure there are no other follicles. Openings in the stroma should always be made from the mesovarium to the free border parallel with the vessels. There will be little bleeding. The cortex is sutured to the peritoneum of the mesovarium making a new white line and widening the mesovarium. If there is bleeding more sutures may be required but there is seldom need to completely close this opening. Fine cat gut on atraumatic needles should be used.

filtrates and penetrates the surrounding tissues thus making a path for the chosen follicle. The actual rupture after the follicle

reaches the surface of the ovary and protrudes beyond is caused by the cessation of proliferation of the theca cells while the membrane be-



Fig. The normal position of the uterus and its adnexa. Illustrations in textbooks convey the impression that the tube is 'box' the ovary and the latter exposed to the peritoneal contents while all are spread out over the width of the pelvis. This sketch is presented to show the ideal location of the tubes and ovaries but of course this could not be attained in any case of this series because no tubes were present. This relation of the tube-ovary and broad ligament may account for the absence of adhesions to the ovary although raw surfaces due to ovulation are constantly being exposed. While this may not be the true reason, placing the structures in this relation after surgery of the ovary will prevent adhesions. The ovary should be pulled out of the cul-de-sac. This is usually accomplished by suspending the uterus according to the Bagdo Webster method.

tween the interior of the follicle and the peritoneal cavity becomes progressively thinner. Circulation on top of the vertex of the graafian follicle is interfered with by internal pressure and the capillaries do not contain blood cells inducing atrophy. The slowness of the process permits the rupture to take place in a very smooth manner.

When this action goes on near the ovarian cortex or along the free border little damage ensues if it is not completed. But when it takes place in situations that do not favor successful termination the ovary will now contain a static body which is not readily discernible yet can alter more or less permanently

the entire internal structural pattern. This can and much more frequently than is popularly realized does, happen without any enlargement whatsoever and with no indication on the surface of the ovary of the disturbed conditions beneath.

These locations are deep in the center of the ovary and high up in the hilum between the white lines. Here the accidents of nature and the elements of chance come into play. There is no way of predicting which group of follicles is to be selected for maturation and it is pure misfortune when an adversely circumstanced one is picked. Exploration of such ovaries in the living quickly brings the realization of the futility of hormone therapy and explains some of the failures of this type of treatment in cases in which it would seem to have every opportunity to succeed.

#### ABSTRACT OF A CASE

Since all the patients presented a similar syndrome it would be needlessly repetitious to describe each one in detail. They differed from each other only in the prominence of a symptom or a sign. All the 16 women were between the ages of 25 and 33 and had had the first operation when both tubes and one ovary were removed from 1 to 9 years previously. Fourteen were white and two were colored. The diagnosis presented no problem and in deed often was made by the patient herself.

#### A typical case history follows

Mrs. C. L. C., white age 33 years was operated upon 9 years ago when both tubes and the right ovary were removed. She remained perfectly well for 6 years and her menstrual cycle and psychodynamic state were normal. Then she noticed that she was becoming more irritable and irascible there was a reduction in the duration and quantity of bleeding, the intervals between periods became shorter and dysmenorrhea which was often disabling, increased in severity. At times there would be a continuous spotting over a period of weeks. Occasionally she would have severe discomfort in her left side which apparently had no relation to her periods. Colitis became painful and her libido disappeared. Flashes had started during the previous year.

She was a tall well developed, poorly nourished woman who lost her emotional control as she recited her history along with the fact that several doctors had informed her that the remaining female organs would have to be taken out. She had already received endocrine therapy. With the exception of the psychological disturbance no abnormalities were

found besides those pertaining to the genitalia. Tenderness, spasm and rebound tenderness in the left inguinal region were present but no masses were discovered. The cervix was slightly enlarged and the uterus was normal in size moderately retroverted and sensitive. While no actual tumors could be made out in the left adnexal region some thickening was noted and extreme tenderness was elicited with just moderate pressure.

At operation (January 8 1945) the old midline scar was excised and the abdomen entered after many intestinal attachments were separated. Both tubes and the right ovary were absent and the pelvic peritoneum was thicker than normal. The left ovary was buried in a mass of adhesions and when released was found to be about 1½ inches in diameter and under severe internal pressure. A cyst at the free border was inadvertently opened and found to contain dark grumous material. Several other small follicles containing the same matter were around the larger one. The mesovarium which was on tension and partially twisted was freed and the circulation to the ovary exposed. The hilum and mesovarium were then opened and explored. Several small follicles, each about ¼ inch in diameter and one about ½ inch in diameter along with one corpus albicans were removed. These did not reveal themselves in any way along the surface of the ovary. To maintain the ovary in as favorable position as was possible under the circumstances and keep it out of the pelvis the round ligament was shortened and several reefing sutures were taken in the infundibular ligament. The abdomen was closed and the convalescence proceeded uneventfully.

She was discharged from the hospital in 10 days with instructions to return after the first period was over. She came in jubilant. The period lasted 4 days, was without pain and the flow was much greater and of normal color. In a few months she reported again. Her constant emotional tension had disappeared and premenstrual distress was comparatively mild. Her libido was regained the flushes and irritability vanished and she increased 10 pounds in weight. In fact she presented an entirely different personality which seemed to emanate just as much from the disappearance of tension as from the relief of discomfort. She has continued to maintain this improvement up to the time this report was submitted for publication.

The others have been almost as fortunate although the result was not obtained so quickly. Relief from suffering restoration of the cycle and emotional adjustment eventually was obtained in every one. One has endured for 3 years but now has some menopausal symptoms at 34. Another began missing periods a year after operation but now the regularity has returned. Three could not be traced more than 6 months but the rest are without discomfort and are enthusiastic about the outcome.

#### TECHNIQUE OF OPERATION

Bonney an ardent advocate of conservatism states that "there is a pleasure pride and satisfaction in conservative operations which cannot be appreciated save by those who have performed them but it requires of the surgeon that he should forego a procedure which achieves a striking result in a startlingly short time for one which though it takes longer has far greater appeal to the connoisseur." (4) This certainly applies to ovarian exploration. Judging from the results of the whole series of cases sometimes disappointment and failure were converted to success only after several months had elapsed.

This operation is not the same as the ovarian cystectomy of Bonney the decortication procedure of Reycraft the splitting operation of Bailey or Stein's excision of a wedge at the ovarian border. None of these attack the impeding factors at their source in the ovarian hilum between the ventral and dorsal white lines and all are more or less empirical in their approach. While undoubtedly effective they fail to recognize the pathology that may exist in the narrow and vital area where vessels and nerves make their transition from the mesovarium to the ovary and provide no method for correcting it.

The first step in exploring the ovary is to examine the mesovarium observing particularly the number of vessels going to the ovary and the presence of varicosities. The latter are usually part of a general varicose condition of the broad ligament and when present must be taken care of first. Because of the previous operation the mesovarium of every ovary in this series was distorted by adhesions rotation or malposition and it required much manipulation to bring about the normal relationship again. Without previous surgery the mesovarium is usually clear. Restoration of a straight mesovarium without deformity and with the ovary properly suspended is of supreme importance. This is often difficult and requires much finesse when adhesions between the ovary and whatever happens to be covering it are divided.

The ovary is held by the fingers, as instruments may do damage because of the friability of the tissues. A clamp is *not* placed across the



mesovarium to prevent bleeding since cutting off the blood supply even for so short a time reduces the internal stresses in the ovary and prevents accurate observation of the state of the circulation. If the operation is done properly the loss of blood is negligible and I have not found it necessary to remove an ovary on that account though more than 300 have been explored.

After the mesovarium has been straightened and the position and thickness of the white line have been noted an incision about  $\frac{3}{8}$  inch long is made into but not through the cortex parallel and close to either border just below the line. A flat double edge tonsil knife with a round sharp end is then used to separate the cortex from the stroma. With the knife held in the same plane as the surface of the ovary the end is placed in the incision and with a few short strokes the remainder of the cortex is cut through and the back of the knife sinks in to the ovary against the stroma. Thus the blade is accurately placed between the cortex and the stroma. Holding the curved sharp end firmly under the surface of the cortex the knife is passed across the ovary until the end can be felt near the opposite border when a small incision is made over it allowing the end to come through. It is not easy to pass the knife across the ovary. One will be amazed by the density and firmness of the tissues, but by using the twisting movement of an oyster shucker and unhesitatingly overcoming any resistance the cortex can be separated from its underlying stroma without injury to either.

Keeping the knife in that position an opening is made about the middle of the ovary right over the knife and a clamp is inserted into this opening pointing upward parallel to the vessels in order to spread this incision wide and dissect up under the white line and into the mesovarium just beneath its peritoneum. The cortex is then divided over the knife between the two end incisions and the knife is withdrawn. The hilum of the ovary is now exposed and the interior of the ovary is accessible. Unless bleeding is profuse which seldom happens no effort is made to stop it.

The edges of the open white line are grasped with Allis forceps and that part of the cortex is dissected upward and cut off. One must not

cut too close to the ovary as blood vessels which are close under it might be severed. The finger is inserted into this opening and the position of the cysts or corpora albicantia, which cannot be detected through the intact cortex can easily be discovered by palpation with the forefinger.

The latter are broken up with a pointed probe but follicles should be enucleated if possible. This may be done with the sharp round end of the knife. If one bears in mind that the trabeculae of the stroma run parallel from the mesovarium to the free border and works only in that direction there will be little bleeding and few ovarian cells destroyed. If it is not practicable to shell out the follicles they should be opened but the aperture must be made adequate and sufficient to scan the interior to detect smaller follicles within.

Careful inspection of the wall of a follicle will disclose why puncturing rarely suffices for their complete disposal. The majority are not single follicles but a nest of several with one large and a few smaller ones. Piercing the large one merely permits it to refill or else allows one of the smaller ones to expand and occupy the space. Frequently what appears to be one large follicle may be a cluster of several smaller ones of almost equal size which together present the appearance of a single well rounded cyst.

It is not imperative that these structures be taken out. There is no pathological condition at hand that can be considered a disease. The effort is directed at relieving obstruction and strangulation. That is why partial resection of an ovary is silly. The part left behind still contains the same impediments and the only change has been an unnecessary and certainly undesirable reduction in the total ovarian capacity.

When the exploration is completed the ovary may be reduced in volume and one will often find that what externally seemed to be an ovary of normal size and shape actually consisted of only  $\frac{1}{3}$  stroma and the rest follicles of one kind or another. Hence to allow for possible expansion of the stroma the cortex should not be closed too tightly. Using fine catgut on atraumatic needles the lower border of the open cortex is joined to the open peritoneum.

of the mesovarium so the latter becomes a straight line along with that of the cortex, in effect a new white line is created. Two sutures placed close to the apex of the incision into the mesovarium are usually enough and no more are needed unless there is oozing. Clamps, forceps, large needles or catgut and coagulation are avoided to prevent scarring. With the closure completed the ovary is now replaced and sutured as nearly as possible to its normal position and well above the cul-de-sac. In this series that could not always be done, but without the scarring and distortion of a previous operation it can usually be accomplished.

#### ADVANTAGES OF OPERATION

This procedure is not intended for those who do not have the remainder of the cyclic endocrine factors intact. It is not a substitute for and does not provide follicle or pituitary stimulating hormones. Women who once have had the elements of periodicity and have suffered significant deviations are likely candidates. The ovary and endometrium should be considered in the light of final links closing the procession of events in the menstrual cycle. They play a major endocrine rôle too just as important as others, but are much more liable to misfortune. Re-establishment of the ovarian link is the major objective for which fortunately these organs are accessible.

Nor should the operation be suggested until all other measures have failed to bring about improvement. In these 16 cases there was little likelihood of that happening but treatment was attempted and was of no avail. When two ovaries are present the chance for a therapeutic result are, of course much better.

Returning to the concept of the etiology and pathology I have depicted it would seem that this operation would be futile aside from its value for this clinical study, since with only one ovary present the same abnormality is likely to recur. Perhaps that is true but before the recurrence takes place the woman is that much further along toward the normal time for the menopause and her adjustment to it has made comparable progress. It has been my observation that the artificial menopause, when precipitated in young women

either surgically or roentgenologically, is much more severe with more intense reactions than when it takes place at the proper age. A gain of 3 or 4 years is valuable and the probability of disruptions of the psychodynamic state is much less and in direct proportion to the number of intervening years. Hence the closer the time of the artificial menopause approaches that for the normal climacteric the less likelihood there is for physical and mental upsets. These women readily accepted the idea of preserving whatever is left of their ovarian function and their continued enthusiasm over the outcome has not only been gratifying but signifies that their fervor is not the transient elation of convalescent patients. The results of ovarian inadequacy with its accompanying deprivation of estrogen is no light matter and is a constellation of emotion and feeling which the masculine mentality grasps only with the greatest difficulty if indeed he does at all. If only he would match his zeal for preserving ovaries with that which he has for retaining testicles there would be much less repressed and concealed misery as a result of his gynecological endeavors. Although synthetic and natural hormones are available which can be administered to imitate after a fashion the normal cyclical variations they are as yet only a poor substitute for those that are derived from within.

The popular surgical notion that the menopause when brought about prematurely reaches an end and takes place just that much earlier, is a cruel fallacy. The menopause does not terminate after having been artificially created until the natural span for that individual has elapsed. In the vast majority of such women who have come to my attention there are disagreeable sensations of discomfort at about the time the period usually takes place to say nothing of permanent alterations such as the gain in weight and the change in personality. The latter cannot be dismissed as merely an intensification of psychic factors already in operation. Only the most phlegmatic escape and then not entirely. Moreover at the normal time for the climacteric, after the patient has been tormented by these recurrent feelings perhaps over several years a new set of symptoms appears and endures for many

more months. These consist mainly of severe flushes, headaches, vertigo and emotional outbursts but one such patient who had an artificial menopause at the age of 35 at 49 developed severe depression hallucinations, agitation paranoia epistaxis, and dermatographia. The syndrome eventually was controlled by adequate estrogen and psychotherapy but for a while it seemed that sanatorium care would be required.

It is not generally recognized that excision of a tube may be the prelude to impairment of its ovary. Although it is thought the circulation is not injured there is no way of knowing because of the infinite variations just where and how the anastomosis between the ovarian and ovarian branch of the uterine artery which usually carries the largest volume of blood to the ovary is maintained. In addition after the tube is removed the ovary is drawn to the uterus by the sutures ligating the vessels of the broad ligament and thus the infundibular ligament containing the ovarian artery is put on tension. The creation of scar tissue and adhesions limiting the mobility of the ovary completes the picture.

And there is seldom need for removing a tube. Tubal disease even in the face of wide spread infection with purulent collections inside and outside the tube is not an indication for salpingectomy. On many occasions when the pelvic adnexa seemed to be one inflammatory mass I have uncovered the medial ends of the tubes evacuated their contents and divided and ligated them at that point. In addition it was necessary to maintain a stoma to prevent subsequent painful hydrosalpinx. So when the fimbriated end was closed another opening was made somewhere along the tube. This was still less hazardous and certainly not as shocking as taking out a tube from friable inflamed and bleeding tissues to which intestines usually were closely and sometimes inseparably adherent. Recovery has been so complete that little evidence of pelvic infection either functionally or by examination can be found. It seems that the whole pathological process just melted away like the redness, swelling and edema disappear around a healing furuncle. And it is just as illogical to excise these inflamed tissues

as cutting out the whole area of inflamed skin to heal a furuncle. Some of these cures have endured for 10 years. Even when the tube has been ruptured by an ectopic gestation it is necessary only to remove the latter divide the tube at its medial end to prevent recurrence and sew up the bleeding area to control the hemorrhage.

Similarly there are but few reasons why an ovary should be removed. Among these are of course cancer and gangrene caused by twisting of the pedicle. Possibly it may be best to remove an ovary that contains a cyst so enormous that there is little likelihood of retaining any functioning part. But there is no need to take out an ovary or even part of an ovary for nonproliferative retention cysts ovarian hematomas dermoids or an ovary that has been shriveled by a fibrotic process. Falk advocates removal of a circumscribed tubo-ovarian abscess but I have found even that unnecessary. Evacuation of the purulent material and division of the tube is all that is required. There is no way of predicting to what extent the ovary will regain its function after adventitious processes are no longer operating. Sometimes only a shell is left, but that part may contain enough cells to insure the continuance of function.

There is always the danger when exploring an ovary of uncovering a malignant or potentially malignant process and spreading it over the peritoneum. I have not encountered this yet and hence believe that while it is possible it is highly improbable.

Exploration of an ovary is not difficult and need not be reserved for only those cases where the diagnosis has been made before operation. I believe it should be part of every laparotomy where these organs can be reached. With prudence and proficiency there is little to lose and much to gain. It is a means for giving a fresh start to an ovary which may seem normal but yet is under the handicap of submerged follicles that give no indication of their presence on the surface. In these 16 cases there was no doubt of the diagnosis but their success was based on exploration of a much larger series of ovaries in the living and the concept of the pathology evolved out of the experience with them. A full apprehension

of this pathology often will be the means of retaining ovaries and restoring them to usefulness even in the face of extraordinary lesions which at first blush seem hopeless. But it does require that the surgeon pause and devote some time to the study of the pattern of each malformation whether it be large or small before attaching the fatal clamps. And he must also bear in mind that he has not only the surgical means at hand, but also postoperative endocrine and other therapy which should be more than ordinarily effective since there will be fewer unknown factors to be reckoned with.

#### SUMMARY

Ovaries can be encumbered by follicles which, while they may or may not cause enlargement, do interfere with proper hormone production and ovulation. This is especially true when such follicles develop in the hilum between the white lines just where the vessels and nerves enter the ovary. This is not a disease but rather a misfortune which can be corrected.

The opportunity to prove that these ovaries need not be removed has been furnished by the tendency of surgeons to disregard the many conservative gynecological measures designed to retain the internal genitalia especially those that are so important to the psychodynamic stability of the female. A technique for accurately, not empirically exploring the ovary is presented based upon a conception of the pathology that considers static follicles either large or small as the malefactor. In 16 patients from whom both

tubes and one ovary had been removed and the other had finally become inadequate this remaining ovary was explored with results that demonstrate these organs can be restored to usefulness at least for a time and need be wholly or partially excised only under exceptional circumstances. The success of the operation was demonstrated by the relief of discomfort, restoration of normal cyclicality and the return of emotional tranquility and personality adjustment. This procedure is presented as a conservative gynecological measure which can be applied to nonproliferative cysts of the ovary, the most common cause of ovarian failure.

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more months. These consist mainly of severe flushes, headaches, vertigo and emotional outbursts but one such patient who had an artificial menopause at the age of 35 at 49 developed severe depression, hallucinations, agitation, paranoia, epistaxis and dermatographia. The syndrome eventually was controlled by adequate estrogen and psychotherapy but for a while it seemed that sanatorium care would be required.

It is not generally recognized that excision of a tube may be the prelude to impairment of its ovary. Although it is thought the circulation is not injured there is no way of knowing because of the infinite variations, just where and how the anastomosis between the ovarian and ovarian branch of the uterine artery which usually carries the largest volume of blood to the ovary is maintained. In addition after the tube is removed the ovary is drawn to the uterus by the sutures ligating the vessels of the broad ligament and thus the infundibular ligament containing the ovarian artery is put on tension. The creation of scar tissue and adhesions limiting the mobility of the ovary completes the picture.

And there is seldom need for removing a tube. Tubal disease even in the face of wide spread infection with purulent collections inside and outside the tube is not an indication for salpingectomy. On many occasions when the pelvic adnexa seemed to be one inflammatory mass I have uncovered the medial ends of the tubes, evacuated their contents and divided and ligated them at that point. In addition it was necessary to maintain a stoma to prevent subsequent painful hydro-salpinx. So when the fimbriated end was closed another opening was made somewhere along the tube. This was still less hazardous and certainly not as shocking as taking out a tube from friable, inflamed and bleeding tissues to which intestines usually were closely and sometimes inseparably adherent. Recovery has been so complete that little evidence of pelvic infection, either functionally or by examination can be found. It seems that the whole pathological process just melted away like the redness, swelling and edema disappear around a healing furuncle. And it is just as illogical to excise these inflamed tissues

as cutting out the whole area of inflamed skin to heal a furuncle. Some of these cures have endured for 10 years. Even when the tube has been ruptured by an ectopic gestation it is necessary only to remove the latter, divide the tube at its medial end to prevent recurrence and sew up the bleeding area to control the hemorrhage.

Similarly there are but few reasons why an ovary should be removed. Among these are of course cancer and gangrene caused by twisting of the pedicle. Possibly it may be best to remove an ovary that contains a cyst so enormous that there is little likelihood of retaining any functioning part. But there is no need to take out an ovary or even part of an ovary for nonproliferative retention cysts, ovarian hematomas, dermoids or an ovary that has been shriveled by a fibrotic process. Falk advocates removal of a circumscribed tubo-ovarian abscess but I have found even that unnecessary. Evacuation of the purulent material and division of the tube is all that is required. There is no way of predicting to what extent the ovary will regain its function after adventitious processes are no longer operating. Sometimes only a shell is left but that part may contain enough cells to insure the continuance of function.

There is always the danger when exploring an ovary of uncovering a malignant or potentially malignant process and spreading it over the peritoneum. I have not encountered this yet and hence believe that while it is possible it is highly improbable.

Exploration of an ovary is not difficult and need not be reserved for only those cases where the diagnosis has been made before operation. I believe it should be part of every laparotomy where these organs can be reached. With prudence and proficiency there is little to lose and much to gain. It is a means for giving a fresh start to an ovary which may seem normal but yet is under the handicap of submerged follicles that give no indication of their presence on the surface. In these 16 cases there was no doubt of the diagnosis but their success was based on exploration of a much larger series of ovaries in the living and the concept of the pathology evolved out of the experience with them. A full apprehension

of this pathology often will be the means of retaining ovaries and restoring them to usefulness even in the face of extraordinary lesions which at first blush seem hopeless. But it does require that the surgeon pause and devote some time to the study of the pattern of each malformation whether it be large or small before attaching the fatal clamps. And he must also bear in mind that he has not only the surgical means at hand but also postoperative endocrine and other therapy which should be more than ordinarily effective since there will be fewer unknown factors to be reckoned with.

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# THE TREATMENT OF EMPYEMA WITH TOPICAL AND SYSTEMIC PENICILLIN AND OTHER ANTIBACTERIAL AGENTS

## An Analysis of Twenty Cases

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**I**N 1943 Drs. John Lockwood and William L. White representing the National Research Council allowed us the privilege of participating on a project directed by Dr. White to determine the value of penicillin in preventing empyema following lung resection. This complication was frequent in spite of refinements of technique and the administration of sulfonamides which had already greatly improved results. The remarkable protection afforded by administering penicillin systemically was soon proved on a small series of patients in whom resection had been done paired carefully with controls who received no chemotherapy of any sort. This work was published in 1944 (7). The complete protection of the treated patients compared with the routine occurrence of empyema in the controls led us to try topical treatment of empyema. We treated some spontaneous pneumococcal and staphylococcal empyemas with increasing success as we overcame the difficulties and improved the technique. With great trepidation we attacked a putrid empyema for which we had the profoundest respect. From sad experience we had come to classify this disease as a surgical emergency next in urgency only to asphyxia and hemorrhage. We removed as much foul pus as possible and reinstalled 25,000 units of penicillin in 25 cubic centimeters of saline. We were so imbued with the need for early surgery in such cases that we intended to institute drainage the following day if there was still a foul odor to the pus. However the following day there was much less pus; it was thinner and there was very slight residual odor. Of even more importance the patient's toxemia and fever were considerably reduced so that we continued

with this form of therapy to complete cure in 16 days. The first 4 cases were included in the report of Lockwood, White and Murphy (4).

At first aspirations were often inadequate in amount or frequency or both, and the doses of penicillin instilled were small. In a few instances culture became sterile quickly in spite of these errors and cure fortunately resulted in spite of the failure properly to apply the basic principles of the treatment of empyema by any method. These basic principles are simple but absolutely essential: (1) evacuation of the pus and (2) obliteration of the cavity. Any method which does not accomplish these ends is a failure. The few reports in the literature of aspiration treatment of empyema before the advent of penicillin indicated a great increase in morbidity and a definite increase in mortality by this method along with the frequent development of chronic empyema and of recurrences. However good though not perfect results can be obtained by the method of adequate aspiration with reinstallation of penicillin pursued vigorously by one thoroughly acquainted with the surgical principles involved. Secondary but very desirable considerations are sterilization of the infected space and re-establishment of pulmonary function which is accomplished only by re-expansion of the collapsed lung and pulmonary exercises. Resort to thoracoplasty is admission of partial failure. The method to be outlined can usually establish the required basic principles and the secondary considerations and can often greatly decrease the period of morbidity. It is essential for routine success that this method be used only by those whose extensive experience with the surgical treatment of empyema has taught them the

vagaries and elusiveness of pus in the pleura and the rapidity with which the lung can safely be re-expanded. Only such persons can recognize failure early and apply proper surgical drainage to accomplish cure and avoid serious complications.

### RESULTS

Twenty patients with empyema were treated by aspirating the pus as completely as possible and instilling penicillin alone or with other agents into the cavity. Sixteen of these were cured by this method and 4 required surgical drainage. The ages ranged from 6 to 64 years, the empyemas were loculated in 18 instances and diffuse in 2 and the capacity the amount of pus extracted at one tap ranged from 18 cubic centimeters as a minimum to 1200 cubic centimeters maximum. Six were pneumococcal infections 4 in pure culture 1 associated with spirochetes and the other with nonhemolytic streptococcus and *Hemophilus influenzae* the latter was one of the failures. Nine others were streptococcal, 4 of them pure cultures of nonhemolytic streptococcus by aerobic and anaerobic culture, two nonhemolytic combined with hemolytic streptococcus one each of nonhemolytic streptococcus with bacteroids or diphtheroids and one was pure culture of hemolytic streptococcus. In 1 case only hemolytic *Staphylococcus aureus* was noted. One was a combination of *Hemophilus influenzae*, diphtheroids and bacteroids, and was another therapeutic failure. The 3 others revealed no growth however the fluid was purulent grossly and cytologically and in 1 case smelled putrid. In 8 cases, the pus was putrid at the first aspiration. The average time of treatment excluding Case 20 was 14 days with the longest time 33 days and the shortest only 1 day. The average number of aspirations for the 20 cases was 7.7 and varied from 1 to 18. The average dose of penicillin initially instilled into the cavity was 63,250 units. Seven of the cured patients received no penicillin systemically, although 3 of them had a continuation of sulfonamide therapy by mouth. In fact one patient had been treated for 9 weeks before admission by repeated aspirations and the systemic administration of penicillin, without success. In 9 successful and all 4 unsuccessful

cases patients received systemic penicillin, ranging from 100,000 to 300,000 units per day and averaging about 200,000 units divided into 12 equal 2 hourly doses administered intramuscularly. The pus became sterile after a single aspiration and reinstallation on 7 occasions, after 2 such maneuvers in 2 cases and was not noted in 1 other. Penicillin was not instilled on every aspiration in some of the earlier cases, and taps toward the end of treatment were unsuccessful at times. Bronchial fistula was proved in 8 of these 16 patients and healed without further specific treatment in all. In no case was the fistula a very large one which might defeat such method. A few of these 16 patients had been ill for several months up to 1 year (Table I).

Of the 4 patients who required further treatment one showed *Hemophilus influenzae* which was not susceptible to penicillin in 2 there were multiple loculations and the fourth was somewhat slow in improving, so was submitted to surgical drainage. These patients made a routine recovery after drainage except for the one with *Hemophilus influenzae* in whom two instillations of streptomycin preceding drainage abolished the positive *Hemophilus* cultures but failed to improve the patient's condition. Her recovery even after surgical drainage was extremely slow and the cause for this was never thoroughly explained in spite of repeated roentgenograms bronchoscopies cultures of sputum bronchial secretions of the empyema cavity of the blood and urine and vigorous supportive treatment.

No chronic empyemas resulted in the 16 successful cases and pleural thickening which was quite marked in some at the beginning disappeared completely as shown by roentgen ray and demonstrated in some of the examples depicted in this article. However there were 2 cases in which there was persistent pleural thickening in one biopsy was done as it was feared that a tumor might underlie the empyema. These patients have been followed for from 6 months to 3 years after discharge without further evidence of disease or symptomatology.

### TECHNIQUE

1. Under adequate local anesthesia locate a favorable site near the bottom of the cavity,



TABLE I.—SUMMARY OF CASES

Case Initials Age	Diagnosis	Etiology	Admission	Date discharged	No. taps	Units of penicillin instituted	Days treated	Units of systemic penicillin	Size of cyst, cc.	Bacteriology	Sample after	Brachio- pleural fistula	Remarks
M. S. 47	Empyema, diaphragm, right	Parasitic	3-44	3-4-	3	900	6	None	900	Parasitic, type 1	4 taps	No	Cured. Penicillin instituted only 4 times. Subsequent empyema probably before complete treatment begun.
A. R.	Empyema, diaphragm, left	Parasitic	3-9-44	3-9-44	3	900		None	360	Parasitic	taps	No	Inadequate evacuation early. Small damage.
A. S. 51	Empyema, diaphragm, right, left	Parasitic from lung	3-9-44	3-1-44	5	24,000		Quomo Daily		Parasitic, water-beds	taps	Yes	Cured. Bloody sputum and persistent local pleural thickening, irregular but lasting, resulting only chronic pleuritis.
B. D. 46	Empyema, diaphragm, right, left	Parasitic lung	3-9-44	3-3-44	6	10,000		None	30	Nonbacterial streptococcus, bacteremia	taps	Yes	Cured.
R. D. 49	Empyema, diaphragm, right, left	Diffuse sup- purative parasitic lung, bilateral	3-30-44	3-13-45	3	5,000	8	None	30	Nonbacterial streptococcus	taps after local penicillin	No	Cured. Subcutaneous systematically.
R. O. 6	Empyema, diaphragm, right	Parasitic	3-13-45	3-1-45	4	24,000	7	None	3	Nonbacterial streptococcus, diphtheria	taps	No	Cured. Subcutaneous systematically. Penicillin required in same R.I.D., following hospital stay.
A. P. 43	Empyema, diaphragm, right, left	Parasitic lung	3-13-45	3-9-45	3	10,000	7	10,000 daily for 3 days	4	Parasitic, type 1, No bacteremia, streptococcus, diphtheria	Never	Yes	Fulminant bronchopneumonia, death. Subsequent empyema. Rapid incomplete recovery after surgery.
A. S. 31	Empyema, diaphragm, right	Parasitic	3-17-45	3-17-45		5,000		10,000 daily for 3 days	10	Parasitic, type 3	taps only	No	Cured. One other unsuccessful tap. Dramatic response. Absorbent.
P. B. 40	Empyema, diaphragm, right	Bacterial diaphragm abscess lung and bilateral	3-18-45	3-17-45	6	24,000 first 10,000 there- after	5	None	210	Nonbacterial streptococcus	3 taps	Yes	Cured. Illus chronic cough, possibly from bronchiectasis.
H. R. 30	Empyema, diaphragm, right	?	4-3-45	3-19-45	3	9,000	3	10,000 daily for 10 days	170	Nonbacterial streptococcus, bacteremia, streptococcus, abscess lung, abscess bilateral	Never	No	Never standard. Poorly communicating secondary lesion. Rapid recovery after surgical drainage.

TABLE I.—SUMMARY OF CASES—Continued

Case Initials Age	Diagnosis	Etiology	Admitted	Time elapsed	No. taps	Units of penicillin instilled	Days treated	Units of systemic penicillin	Size of cavity cc.	Bacteriology	Sterile after	Broncho- pleural fistula	Results—Remarks
A. A. 64	Empyema, locu- lated, purified, right	Bronchec- toma, bi- lateral	7-9-43	8-26-43	4	0,000	7	00,000 3 days 300,000 7 days	40	No growth	?	No	Cured of empyema. Follow-up 15 months later. Significant improvement in management of bilateral bronchiectasis
M. L. 30	Empyema, locu- lated, purified, right	Post lobectomy	8-13-43	9-1-43	4	100,000 first 3 taps 50,000 last	4	100,000 daily for 4 days	50	Asaccharic, nonhemolytic treplococcus	taps	N	Cured. Sulfonamides systemically first 3 days
J. W. 37	Empyema, locu- lated, purified, left	Post lobectomy	9-7-43	9-5-43	6	00,000 50,000 50,000	5	50,000 daily for 5 days	35	Hemolytic Streptococ- cus aureus	4 taps	No	Cured. Return to larger dose of penicillin and addition of sulfonamide required to sterilize
B. K. 38	Empyema, lacteolar right	Pneumonia	1-21-43	2-2-43	4	5,000 first tap 20,000 other taps		00,000 daily for 5 days	20	Hemolytic treplococcus, nonhemolytic treplococcus	N nega- tive cul- tures re- ported	N	Cured. Penicillin inhalations for 5 days also. Follow-up 9 months no recurrence
C. K. 37	Empyema, multiloc- ulated, purified, left	Post lobectomy	2-3-43	3-8-43	7	30,000 taps 30,000 units streptomycin cls. 4 taps	6	30,000 33 days 330,000 days	60	Bacteroides, dysenteriae, Hemophilus fluores	Never	Yes	Fulminant multiloculated cavity. Small amounts of streptomycin locally and sulfonamide systemically for sterilization. Poor response even after surgery. Cleared cavity and pleural empyemas. In- creased clinical improvement
J. A. 6	Empyema, locu- lated, left	Pneumonia, pneumothorax	2-2-46	2-7-46	5	100,000	6	200,000 daily for 4 days	00	No growth Pathology showed empyema	1 tap	Yes	Cured
W. D. 46	Empyema, locu- lated, purified, left	Post pneumonia	4-6-46	5-2-46	13	200,000 first tap 00,000 thereafter	13	None	200	Hemolytic treplococcus	taps	Yes	Cured. Had been treated by systemic penicillin and thoracentesis for 9 weeks before admission. Follow-up 3 months; patient well and working
W. A. 56	Empyema, locu- lated, left	Carcinoma, pulmonary	5-25-46	7-9-46	6	00,000		200,000 daily for 16 days	70	Pneumococcus	taps	N	Cured of empyema. Pneumocystectomy done on 6-11-46 without postoperative in- fection. Treated by systemic penicillin and sulfonamides before
M. H. 6	Empyema, locu- lated, left	Bronchec- toma	7-4-46	8-6-46	3	00,000 first 6 taps 50,000 thereafter	23	300,000 daily for 24 days	300	No growth	?	Yes	Cured
L. R. 55	Empyema, locu- lated, purified, right	?	8-16-46 9-20-46	9-30-46	3	200,000 taps	?	200,000 daily for 11 days	90	Asaccharic nonhemolytic treplococcus	Never	N	Failure. Ureteritis, irregular treatment. Surgical drainage at expiration

with a No. 20 gauge needle. Then insert a No. 14 or No. 15 gauge needle and use a 30 cubic centimeter syringe with a two-way stopcock as the best means of aspirating the fluid. If the pus is thin use a modified aspirator devoid of the little Potain valves which are useless and are often completely stuck or partially blocked by rust or cooked exudate. It is important to aspirate all the pus possible do not be satisfied with less than appears to be present from the physical signs and roentgenograms. It is usually impossible to get all of the pus since some is present below the level of the needle; this pus can be diluted and largely evacuated by lavaging with normal saline or azochloramide in a 3,300 aqueous solution. In the presence of thick pus which taxes one's ingenuity particularly if there are fibrinous clots with movement or rotation of the needle during release of suction reinsert a few cubic centimeters to blow out fibrinous material lavage and instill azochloramide; this procedure usually overcomes this difficulty. The adequate removal of thick pus is one of the greatest difficulties with this method. For the first 3 or 4 days maintain separation of pleural surfaces by pneumothorax or by volume of fluid reinserted to allow sterilization and to avoid development of multiple loculation if not already present.

2. When the cavity is emptied as thoroughly as possible instill 100,000 units of penicillin, 1 gram of streptomycin or 2 to 4 grams of sulfonamide alone or combined depending on susceptibility tests; in appropriate amount of saline usually 25 to 50 cubic centimeters plus additional air if the capacity of the cavity is above 100 cubic centimeters to maintain separation of the walls.

3. Determine that the organism is susceptible to one of the available agents but continue the treatment until this is determined. If the bacteria are not susceptible to one of the agents available surgical drainage should be instituted without further delay.

4. Repeat procedure daily until cultures are sterile or nonsusceptibility is established.

5. As soon as cultures are sterile obliterate the space as rapidly as possible removing all liquid and gas but continue to instill 50,000 to 100,000 units of penicillin or appropriate

amounts of other agents in small volume as low as 1 cubic centimeter with each aspiration. Aspiration is continued every other day until no more fluid can be obtained and frequent roentgen ray check up reveals no further evidence of pleural cavity when taps may be discontinued.

6. Check up by roentgen ray in 2 weeks and again in 4 weeks using exploratory aspiration if roentgenogram indicates suspicion of persisting fluid or cavity.

7. Give the appropriate antibiotic (or chemotherapeutic agent) systemically. Penicillin is administered in 12 doses intramuscularly 2 hours apart totaling 240,000 units per day or more starting this at the beginning of the topical application. Streptomycin is given in similar fashion totaling 3,000,000 units per day. Sulfonamides are better given by mouth in the usual way.

8. If it is impossible to empty the cavity if susceptibility cannot be established or if satisfactory technique fails to relieve the condition within 10 to 14 days institute drainage.

#### PREVIOUS REPORTS

It is notable that the literature on this method is mostly adverse. A critical analysis however reveals that many of the reports are of small groups; that patients have been tapped irregularly and infrequently; that pus has been allowed to remain in the pleura even though sterilized or that surgical drainage has been instituted at once because of thick pus or the presence of bronchopleural fistula. Consider the article by that excellent surgeon Brian Blades in collaboration with Hamilton and Dugan in which they report 4 cases in which patients were treated at various Army posts. Of these the record indicates that dosage was inadequate in amount or time or both in 9 and that sterile fluid which might have been removed was present in 7, a total of 16 which might have been successful. In only 3 patients were nonsusceptible organisms present and in 3 others there was cure without operation. They note that pus became thicker as time went on although we have observed the opposite in our cases in that the pus becomes thinner from the first tap provided adequate removal is obtained. The reference to thick

pus and the inefficacy of this method occur in other reports including those of Roberts, Tubbs and Bates from England and Poppe who also feel that bronchopleural fistula is a contraindication. Poppe reports a recurrence rate of 53 per cent and quoted Butler Perry and Valentine as having a 28 per cent recurrence rate. He feels that treatment in this fashion greatly prolongs morbidity and that this is another reason it is not justified. We have seen no recurrences with the technique described above and have noted a great reduction in morbidity. He also feels that pleural thickening is more frequent and more crippling with aspiration therapy than with drainage. Prolonged thickening was noted in only two of our aspiration cases and has been present in most of our previous drainage cases as well. The thickness appears to be the response to infection and occurs in proportion to the virulence and duration and has been as routinely present in previous patients treated by surgery alone. Follow up roentgenograms of our patients showed routine disappearance of pleural thickening within a few months in all but the 2 mentioned.

On the other hand Lockwood White and Murphy reported 34 cases of pneumococcus empyema of which 19 were cured in this way with only 10 000 to 25 000 units of penicillin topically. One of these showed *Staphylococcus aureus* *Streptococcus hemolyticus* and pneumococcus. Hirshfeld Buggs Abbott and Pilling seem to have a most rational approach and although they do not state the number treated and the percentage of success they cite successful and unsuccessful cases and they as well as we emphasize the need for maintaining the principles of treatment of empyema with this method as with any other. Brown and associates, in reporting 24 cases of their own and 236 compiled from the literature state that in 144 patients treated with penicillin locally or systemically or both 92 per cent were cured, 26 per cent became chronic and 51 per cent died. In 104 patients treated by penicillin and surgery 90 per cent were cured, 38 per cent became chronic and 58 per cent died. They too call attention to the small number of injections in many cases, often only one or two injections being given

and frequently doses as low as 10 000 units being used.

Much of the criticism of this method may stem from analyses and compilations of cases in which patients were treated by physicians not surgically trained although certainly some of it represents poor results in the hands of good surgeons.

#### CONTRAINDICATIONS

It is quite probable that in certain cases with pus which is too thick for evacuation by large needle and persistent effort with organisms which are not susceptible or with the presence of large bronchopleural fistula which prevents proper lavage or retention of the antibiotic in the cavity, surgery would be necessary but these should be infrequent. The contraindications as they appear to us are

- 1 Inability to evacuate the cavity
- 2 Nonsusceptible organisms
- 3 Inability to maintain antibiotic fluid in the cavity as in large bronchopleural fistulas.
- 4 Multiple loculi although theoretically even this might be overcome by tapping each loculus such tapping generally would not be feasible
- 5 Recurrence

#### CASE REPORTS

**CASE 1.** M S female, age 47 was admitted to the hospital January 2 1944 discharged February 4 1944. Diagnosis empyema diffuse right pneumococcus, postpneumonic.

This patient's illness dates from December 25 1943. She developed cough fever and labored breathing and was treated at home as pneumonia. The cough became more severe and productive and she was referred to the hospital. She presented signs of fluid over the right lower chest posteriorly her temperature was 102.2 degrees and she appeared quite toxic. The roentgen ray examination January 3 1944 revealed a large pleural collection within the right chest with displacement of the mediastinum to the left. February 11 1944 the roentgenogram revealed complete obliteration of the empyema cavity.

The patient was tapped on January 3 1944 and 900 cubic centimeters of greenish yellow fluid were removed. She was started on sulfonamides systemically. No penicillin was instilled on the first tap. After surgical consultation on January 13 1944 taps were done almost daily on January 14, 16 17 18 19, 20 22 and 29 10,000 units of penicillin being instilled at each tap. At the time of the last tap the size of the cavity was approximately 35 cubic centi-

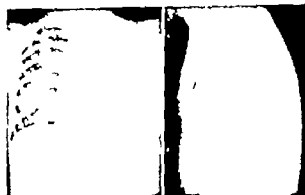


Fig. 1. Case 1. A. R. male. Empyema on left demonstrated on January 9, 1944 the day after admission.

patient. The pleuro-angiocentric fluid was with 100,000 leucocytes were found in the specimens. On January 16, 1944. Following this on three (3) specimens gram positive diplococci were seen in smears, but there was no growth. Following these tapings the pleural fluid was sterile and showed no organisms. The patient received no systemic penicillin. Her pleural fluid analyses consisted of 6 grams per decaliter of sugar on January 21, 1944 inclusive none being given during empyema treatment.

History. The most recent examination of this patient was on December 12, 1946. She had had no further cough, dyspnea or other respiratory symptoms and had gained 118 pounds in weight. There is no recent check up roentgenogram.

CASE 2. A. R. female, age 49, was admitted to the hospital January 6, 1944, discharged February 29, 1944. Diagnosis: empyema massive left pneumococcal.



Fig. 2. Case 2. A. R. Female. February 23, 1944 approximately 7 weeks after admission and 3 weeks after last successful tap. Marked pleural thickening and the usual hithing up of diaphragm after empyema treated by any method appear but no cavity is demonstrable.



Fig. 3. Case 3. A. R., on March 30, 1944, 8 weeks after admission and 8 weeks after last successful tap. Pleural thickening greatly reduced. Diaphragm still elevated.

Cough, fever, weakness and toxemia for the 3 weeks prior to admission beginning insidiously with an upper respiratory infection. Patient presented a marked pallor with signs of fluid in left chest and cervical adenopathy. On January 10, 1944, roentgenogram revealed massive left pleural effusion with the condition of the underlying lung indeterminate.

The patient was first tapped on January 11, 1944, and thick pus culturing pneumococcus, type 3 was revealed. Beginning on January 13, 1944, or 4 days after admission aspirations were done daily with reinsertion of 12,500 units of penicillin. Aspirations were rather small, ranging from 1½ to 90 cubic centimeters, and cultures continued to be positive. On January 19, 1944, a determined effort removed 360 cubic centimeters, and from this point on progress was rapid. Cultures became sterile from January 24, 1944, and for 10 subsequent studies, and only small amounts of bloody serous fluid could be obtained thereafter. From this point on her temperature rapidly returned to normal and she improved clinically. The last successful thoracentesis was February 3, 1944, approximately 10 days after the thorough aspiration and only a few cubic centimeters of serous fluid were removed. On discharge the patient showed complete obliteration of the empyema cavity with some residual pleural thickening. She was asymptomatic, her leucocytosis had disappeared, her sedimentation rate was normal, and physical signs in the chest were practically normal.

Follow-up. The patient was seen up to 34 months after discharge and both clinical and roentgen-ray examinations were entirely normal (see Figs. 1 to 4).

CASE 3. A. S. male, age 55, was admitted to the hospital March 10, 1944, discharged April 12, 1944. Diagnosis: (1) empyema loculated left (2) fistula-bronchopleural (3) abscess subcutaneous.

Five months before admission, a diagnosis of left-sided pleurisy and pneumonia had been made. Since this acute episode the patient had improved but had



Fig. 4. Case 2. A. R. on November 12, 1946, 35 months after treatment showing normal lung fields and pleura. Diaphragm has returned to normal position and activity.

never felt well and had continued to have pain in his left chest with some dyspnea and a persistent productive cough. The cough became worse when he lay on his right side and the sputum was profuse but not foul. He had lost some 10 pounds in weight. In the last 2 weeks he had noted a hard red swelling over the left chest wall anteriorly which had increased in size but had not drained. Examination disclosed enlarged left supraclavicular nodes, lagging and dullness over the entire left chest with suppression of breath and voice sounds. In the anterior axillary line at the sixth rib there was a red, tender mass about 5 centimeters in diameter which was attached to underlying muscles and costal cage. Roentgenograms revealed a hydropneumothorax on the left which was located in the lower lateral portion from the diaphragm to the third rib. There was some infiltration of the left lower lobe suggesting pneumonitis, and accentuation of the lung markings in the right lower lobe suggesting possible bronchiectasis.

Aspiration on March 11, 1944, 2 days after admission obtained 210 cubic centimeters of bloody thick, putrid pus which on culture grew pneumococcus and spirochetes. The red mass was drained and found to be a local abscess not communicating with the pleura which showed a hemolytic *Staphylococcus aureus*. Aspirations were done on March 12, 13, 14, 15 and 17 at which times penicillin 50,000 units was instilled except on the 15th when an unsuccessful tap was encountered. Pus on March 12, 1944 was nonodorous and that obtained on March 13, 1944 was sterile. There was no other positive culture on any subsequent tap. On March 24, roentgenogram showed a reaccumulation of fluid and he was aspirated on this date and on March 25 but on March 27 and March 29 the taps were unsuccessful. How-

ever they were again successful on April 1, 5, 6, 8, 10 and 12. On the last tap only 5 cubic centimeters of thin, very slightly bloody fluid were removed. Penicillin was given intramuscularly from March 10 to 18, 1944 at the rate of 150,000 units per day. He was discharged on April 12, 1944 with a healed wound at the site of the drained abscess and without respiratory symptoms. Roentgenogram showed obliteration of the pleural cavity but continued to show a localized area of pleural thickening. This continued without much change for 6 weeks which increased our fear of an underlying tumor which had been suggested by the bloody fluid. For this reason a biopsy of the pleura was done on May 29, 1944 but only chronic pleuritis was found.

Follow up. On September 24, 1945 approximately 17 months after discharge, the patient had remained free of cough, expectoration and fever, and roentgenogram revealed only slight residual pleural thickening with blunting of the left costophrenic sulcus and elevation of the diaphragm.

CASE 4. B. B. female age 26 was admitted to hospital May 29, 1944, discharged July 3, 1944. Diagnosis (1) bronchiectasis right lower lobe (2) empyema loculated right putrid postlobectomy (3) fistula, bronchopleural.

Bronchiectasis followed the inhalation of grass head at the age of 9 years. Cough and expectoration had been present since and hemoptysis and malodorous sputum were recently noted. Examination revealed dullness of right base otherwise negative. Roentgenogram June 9, 1944 (first postoperative x-ray) showed fluid present along the right lateral chest wall and a fluid level of the fifth interspace in the posterior axillary line. June 24, 1944 the roentgen ray appearance of the chest improved considerably in the past 11 days resulting in disappear-



Fig. 5. Case 6. R. O. on January 30, 1945, fluid posteriorly and laterally following right lower lobe pneumonia.



Fig. 6. Case 6. R. O. 8 days after last successful thoracentesis.

ance of fluid loculation in the posteromedial aspect of the chest. Undrained fluid collections were evident.

Following lobectomy on June 5, 1944, for right lower lobe bronchiectasis done without chemotherapeutic protection, the temperature remained elevated and roentgenograms showed pockets of fluid. On June 13, 1944, thoracentesis was done and 150 cubic centimeters of bloody, foul-smelling fluid were removed and 20,000 units of penicillin instilled. Culture of this material showed *Bacillus pyocyaneus*, many nonhemolytic streptococci and a few bacilli. On June 15, 1944, another tap was done, 150 cubic centimeters of very slightly odorous fluid were removed and 20,000 units of penicillin instilled. Culture was again positive. No subsequent cultures could be obtained. On June 17, 1944, the procedure was repeated, large amounts of air removed and 20,000 units of penicillin instilled. On June 19, 1944, thoracentesis was again done but no penicillin instilled. On June 21, 1944, thoracentesis was done, removing much air but no fluid and 20,000 units of penicillin were instilled. On June 24, 1944, 20,000 units of penicillin were instilled. Air was still present at this time. No other thoracenteses were done. On July 5, 1944, the patient was discharged with a normal temperature. At that time there was practically no sputum. Morbidity after operation had continued with a temperature of from 101 to 103 degrees until the tenth postoperative day when the second thoracentesis was done. The temperature then dropped rapidly to normal and remained so until discharge. No sulfonamides were given.

Follow-up. Following discharge the patient received bi-weekly instillations of penicillin by bronchoscope because of a bronchial fistula and fear of re-contamination; however dosage was not noted. On September 28, 1944, she was seen by us and was absolutely asymptomatic. Roentgenograms taken in Texas in November, 1945, showed no residual cavity or pleural thickening. Two communications received from the patient's family physician 2 years following the procedure stated that she was com-

pletely asymptomatic and roentgenograms of the chest were entirely negative.

CASE 5. E. D. male age 29 was admitted to the hospital November 20, 1944, discharged January 18, 1945. Diagnosis: (1) pulmonary suppuration, bilateral, diffuse; (2) empyema, loculated left.

In 1933 the patient had 13 teeth extracted, following which he developed fever, productive cough, nausea, vomiting, and 3 days later he coughed up a portion of tooth. He developed 5 attacks of pneumonia since this episode, of which 3 were in 1944. He was given a course of sulfonamides on the outside with no relief. He had marked dyspnea and pain in the left lower chest. Examination revealed dullness to percussion posteriorly over both bases extending up to sixth thoracic. Coarse rales were heard over both bases, and breath sounds were diminished. There were tachycardia, fever and weight loss. Roentgenograms November 21, 1944, revealed widely disseminated disease in the lungs, probably nontuberculous in character. December 1, 1944, the chest appearance was somewhat worse than on examination 10 days ago. There was an abnormal density in the left lung which had increased in extent and showed confluence. There was fluid collection in the left base. January 1, 1945, marked improvement was noted with only pleural thickening present. No empyema pocket was found.

Systemic penicillin, 100,000 units, was given intramuscularly from November 24 to December 16, 1944, with little improvement. All sputum specimens were negative for tuberculosis. On January 4, 1945, surgical consultation was requested, and a diagnostic left thoracentesis obtained 5 cubic centimeters of foul greenish pus which grew many hemolytic streptococci. On January 5, 1945, a therapeutic tap removed 350 cubic centimeters of similar pus. The cavity was lavaged with saline and 25,000 units of penicillin in 50 cubic centimeters of saline was instilled. The pus showed the same organisms, but all subsequent cultures were sterile. Thoracenteses were repeated on January 6, 8, 10, and 12, obtaining 90, 40, 25 and 10 cubic centimeters of nonodorous fluid.

which became thinner until the last 10 cubic centimeters appeared to be a solution of penicillin in consistency and color. On each occasion 25,000 units of penicillin were reinstalled. From January 10, 1945, the patient felt much better, gained weight and was free of his distressing cough. His low grade fever disappeared permanently after the first instillation of antibiotic. He was discharged on January 18, 1945, markedly improved clinically and roentgenograms showed similar improvement in the parenchymal disease on the left and in the pleural disease.

Follow-up. Subsequent roentgenograms continued to show bilateral pulmonary disease. The patient was readmitted in November, 1946, with evidence of right-sided pleural thickening and parenchymal fibrosis. However, the left pleural space remained entirely free of infection and has continued so to the present. A right lower lobe lobectomy was performed with resection of a portion of the diaphragm, liver and parietal pleura for his right-sided pulmonary, pleural and hepatic disease which resembled actinomycosis but was not proved microscopically.

CASE 6. R. O. male, age 6, was admitted to the hospital January 21, 1945, discharged March 11, 1945. Diagnosis: (1) pneumonia, right lower lobe; (2) empyema, loculated right, streptococcal.

Fever and cough were present for the 2 weeks prior to admission. He was treated with sulfonamides by his local doctor with no improvement. He was admitted with a diagnosis of right lower lobe pneumonia. Examination revealed an increased respiratory rate and dullness to percussion posteriorly in the regions of the right middle and lower lobes. Breath and voice sounds were diminished. An occasional moist rale was heard over the right base. Roentgenogram January 22, 1945, revealed consolidation of the right middle and lower lobes, interpreted as pneumonia. There was a question of fluid in the right pleural space. January 30, 1945, pneumonia had resolved. There was appreciable fluid collection in the right pleural space which appeared to be loculated. March 10, 1945, roentgenogram showed no evidence of pleural disease.

The patient was placed on sulfonamides on admission with immediate improvement. A dosage of 3 grams daily was given from January 21, 1945, to February 10, 1945. His temperature returned to normal the third day after admission. One week after evident resolution of pneumonia, the patient developed signs of fluid in the right chest and temperature elevation. A diagnosis of empyema was made. Thoracenteses were done on January 20, 30, and 31, and February 3. The initial tap produced 18 cubic centimeters. Bacteriological examination revealed an anaerobic, nonhemolytic streptococcus on January 20, 1945. Thereafter all fluid was sterile. The first three thoracenteses were productive. At the last tap no fluid could be obtained. Penicillin 30,000 units was instilled at each tap. He was begun on 100,000 units of penicillin intramuscularly daily on January 30, 1945, which was continued until February 21, 1945.



Fig. 7. Case 6. R. O. 19 months after treatment. Entirely well.

Follow-up. Since discharge the patient has had no recurrence of chest symptoms. He was seen in August, 1946, at which time he had no pulmonary complaints. Examination of the chest was entirely negative and check-up roentgenograms showed no pathologic change and no evidence of pleural disease.

CASE 7. A. P. female, age 43, was admitted to hospital January 31, 1945, discharged April 25, 1945. Diagnosis: (1) bronchiectasis; (2) empyema, posterior left; (3) fistula, bronchopleural.

The patient had a left lower lobectomy 6 months prior to this admission. She had a known bilateral bronchiectasis and a history of asthma. On January 20, 1945, she noted upper respiratory infection with chills, fever and pain in the left lower chest and abdomen. A productive cough began on the date of admission. Examination revealed an acutely ill woman. Her respirations were 36, pulse 144, and temperature 103 degrees. There was a lag in the left chest with dullness at the left base posteriorly and signs of fluid in this region. Roentgenogram February 1, 1945, revealed a large hydropneumothorax in the left chest with a broad fluid level. The left upper lobe was collapsed. April 10, 1945, roentgenogram revealed thickened pleura in the left chest, but no air or fluid pocket.

On admission the patient was markedly debilitated and showed a morbidity which persisted throughout her hospital stay. Her temperature spiked as high as 102 to 103 degrees daily. The first two taps showed no purulent material and revealed no organisms. The first measurable amount of fluid was obtained on February 1, 1945, when 10 to 15 cubic centimeters were removed with large amounts of air. Culture on this material was sterile. The tap was repeated on February 8, 1945, but no fluid was obtained. On February 19, 1945, 60 cubic centimeters of malodorous pus were withdrawn and 16,000 units of penicillin instilled. Bacteriological examination revealed pneumococci type 5. On February 21, 1945, 100 cubic centimeters of odorous pus were removed and 20,000 units of penicillin instilled. On February 23, 1945, 180 cubic centimeters of thick





Fig. 8. Case 6. H. R., on June 6, 1945 admission films showing loculated empyema, right base posteriorly.

brown nonodororous fluid were removed and 20,000 units of penicillin instilled. Failure to respond to this sporadic treatment and the scarcity of penicillin made us elect surgery. On February 26, 1945, the cavity was opened and drained. The empyema fluid never became sterile on the infrequent penicillin instillations. The left upper lobe remained atelectatic until controlled drainage with suction was placed in the left pleural space. On April 11, 1945, a small cavity near the apex was discovered and this was tapped on April 11 and 12, 20,000 units of penicillin being instilled each time. The material obtained from this pocket was sterile. The underlying lung disease probably played a large factor in this patient's continued morbidity, and she was discharged at her own insistence running a moderately septic temperature.

**Follow up.** The patient was seen again in June, 1945, on a readmission at which time she showed marked debility and edema due to protein deficiency. Roentgenogram at this time showed a fluid level in a new location in the apical portion of the left chest which was definitely localized in the pleural space. There was marked parenchymal adjacent lung disease. The patient was also still draining through the drainage opening in the fifth left rib bed made on the previous admission. She has been seen since in the out patient department and continues to get along with difficulty, having dyspnea and a thmatic symptoms, although less than before lobectomy and slight drainage through the thoracostomy wound.

This patient was subjected to lobectomy originally after considerable thought and discussion in the chest conference. The bronchiectatic left lower lobe was removed in the belief that her severe asthma was produced by bacterial allergy from the bronchiectatic focus. She was improved and although she still has asthma it is much less severe.

Infection in the pleura was produced by a respiratory infection 6 months following lobectomy. There was difficulty in locating the pus. There were multiple pockets, the pus was malodorous, although only pneumococci could be grown from one of the pockets, and penicillin was scarce. She was therefore drained 27 days after admission and this, too, was not very satisfactory although adequate access was obtained by rib resection. She refuses additional surgery and we agree with her.

**CASE 8.** A. S. male age 35, was admitted to the hospital February 27, 1945, discharged March 17, 1945. Diagnosis empyema loculated right, pneumococci postpneumonic.

The patient was well until January 1945 when he developed what was diagnosed as lobar pneumonia on the right. He was treated with sulfonamides at home and his fever disappeared. A few weeks later he noted a temperature elevation each afternoon. He lost 34 pounds. Two weeks before admission he developed diarrhea, pain in the right chest, a productive cough and dyspnea. Examination revealed flatness at the right base posteriorly. Crackling rales were heard at both bases posteriorly. Breath and voice sounds were diminished on the right. There was slight abdominal distention. Roentgenogram February 28, 1945, revealed 2 fluid loculations in the right lower portion of the right pleural space, one lateral and one posterior. There was abnormal stringy density present in the left lower lobe. Roentgenogram March 12, 1945, showed that no significant change had occurred during the past week. At the time of discharge x-ray examination showed only a small residual cavity in the right lower pleural space.

The first tap was done on March 5, 1945, and 20 cubic centimeters of frank, nonodororous pus were re-

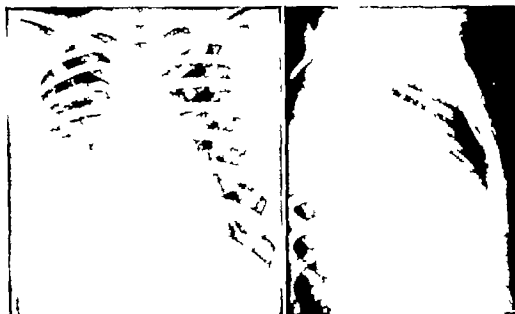


Fig. 9. Case 10. H. R., on June 18, 1945 after 12 days treatment showing multilocular cavity. Still had positive cultures. Drainage instituted the following day.

moved and 25,000 units of penicillin were instilled. The pus was cultured and showed pneumococci, type 5. Patient's temperature immediately returned to normal and his clinical improvement was dramatic. No other taps were successful in obtaining air or fluid. The patient received no systemic sulfa therapy. He received systemic penicillin from March 2, 1945 to March 17, 1945, 100,000 units daily.

**Follow-up.** This patient was seen by his family physician until 1 year ago, at which time he had had no recurrence of symptoms, was perfectly well and was working. We had an opportunity to examine him in January 1947. He had no recurrence of symptoms at that time and a roentgenogram taken then was negative.

It is of interest to note a cure in this case without obliteration of the multiloculated cavity at the time of discharge. We consider it an error to take such risk.

**CASE 9.** F. H. male age 40 was admitted to the hospital March 28, 1945, discharged April 17, 1945. Diagnosis (1) empyema loculated right (2) fistula bronchopleural.

In April 1944 the patient developed a productive cough, dyspnea on exertion, pain in the right chest, ankle edema and easy fatigue. In September 1944 he had an appendectomy followed by a subdiaphragmatic abscess which was drained in October 1944. He states that his chest was also drained shortly thereafter but only one scar is visible. The cough has persisted since. Examination revealed dullness in the right chest posteriorly up to the seventh rib with decreased breath sounds. Roentgenogram March 28, 1945 showed a large hydropneumothorax in the right base extending to about the seventh rib posteriorly. May 3, 1945 roentgenogram showed no fluid in the right base since the examination 3

weeks previously. Pneumonitis in the right lower lobe was clearing.

The patient had occasional morbidity with temperature reaching 100 degrees as on the day of admission. On March 29, 1945, the day after admission, thoracentesis was done and 350 cubic centimeters of fluid were removed which grew anaerobic nonhemolytic streptococci. The fluid was nonodorous. It was repeated on March 31 and April 6, 1945. Penicillin 40,000 units was instilled on the first tap and 20,000 units on each of the following taps. Cultures were sterile after the third tap on April 6, 1945. Morbidity disappeared rapidly and the patient improved markedly. His sputum volume had dropped from 300 cubic centimeters to zero in 6 days. No sulfonamides or systemic penicillin were given.

**Follow up.** Unfortunately we have no follow-up roentgenograms of this patient; however we have had two communications from him in which he stated he had numerous lower respiratory infections, probably on the basis of his residual parenchymal disease. He has had no episodes which resemble his previous attacks and is fever free and symptom free for long periods of time between these infectious episodes. He will not return for further study but probably has right lower lobe bronchiectasis.

**CASE 10.** H. R. male age 30 was admitted to the hospital June 5, 1945, discharged July 19, 1945. Diagnosis empyema loculated right.

The patient was well until 14 days before admission at which time he began to feel weak and listless and on May 26, 1945 he developed nausea. The symptoms increased and he developed a dry, non-productive cough and had a gradual increase in temperature which on admission was 104 degrees. Examination revealed limitation of expansion of right chest, dullness from sixth thoracic down in the right axillary region with impairment of voice and breath



Fig. 6. Case M L., on August 22, 1945 fluid in right pleural space 1 month after right lower lobectomy for bronchiectasis.

sounds. Crackling rales were also heard in this area. Roentgenogram June 6, 1945 revealed a large fluid collection in the right pleural space possible empyema which appeared to be loculated. On June 18, 1945 roentgenogram revealed an empyema loculus 8 by 4 by 4 centimeters. There was also another loculated collection at the right base more posteriorly situated (Figs. 8 and 9).

His temperature on admission was 104 degrees and his pulse 140. He was given sodium sulfadiazine intravenously for 2 days and sulfadiazine orally for 4 days. Penicillin 330,000 units daily was given from June 6 to 25, 1945. He received thoracenteses daily from June 6 to 18, 1945 with evacuation of all available pus and instillation of 50,000 units of penicillin. On the first tap 550 cubic centimeters of pus were removed. On aerobic and anaerobic culture the pus showed hemolytic and nonhemolytic streptococci. These were present in all specimens obtained. The patient showed slight improvement after the first few thoracenteses, but improvement was slow and his temperature never reached normal. On June 18, 1945 it was decided to do an open drainage because of continued positive cultures, and at this time a second partially drained loculus over the diaphragm was discovered. The patient improved rapidly after drainage and was discharged 1 month later.

Follow-up. The patient was seen in the hospital on September 7, 1945 with no recurrence of symptoms. Follow-up films showed complete resolution of the empyema and only minimal pleural thickening. Letters up to April 1, 1946 stated that he had had no recurrence of symptoms.

CASE 11: A male age 64 was admitted to the hospital July 19, 1945 discharged August 26, 1945. Diagnosis (1) bronchiectasis (2) empyema loculated right, putrid.

The patient was well until October, 1941 when he developed pneumonia from which he recovered, but 4½ months later he again developed pneumonia from which he recovered after a long period of convalescence. He stated that his temperature never returned to normal. He was admitted to a hospital on July 22, 1942 and a diagnosis of left lower lobe bronchiectasis was made. His symptoms which had continued until his admission on July 19, 1945 were weakness, poor appetite and fever. Examination revealed dullness to percussion in the right base posteriorly with crackling rales in both bases a scar from previous drainage on the left tachycardia with questionable cardiac enlargement. Roentgenograms on July 20, 1945, showed abnormal density in the right lower hemithorax on the basis of marked pleural disease. Empyema was not suggested by these films. August 7, 1945 films revealed a well demarcated empyema loculus in the right base in the midclavicular line. On August 22, 1945 the pleural parenchymal disease in the right base appeared to be stationary and only the possibility of fluid in the old empyema loculus previously described was noted.

On admission the patient was markedly debilitated with a septic type of temperature reaching 103 degrees daily. On July 19, 1945 he was placed on penicillin systemically 100,000 units intramuscularly being given daily and this was increased to 300,000 units August 2, 1945. On August 7, 1945 a loculated empyema was discovered and treatment by aspiration and instillation of penicillin was begun. Aspiration on August 8, 1945 obtained 40 cubic centimeters of grayish yellow putrid pus, and 100,000 units of penicillin were instilled. This pus never showed any organisms on smear or culture. On August 9, 1945 a small amount of thick pus was aspirated the cavity was irrigated and 100,000 units



Fig. 12 Case 12 M L on September 6 1945 15 days after admission and 12 days after last tap. Follow up 4 months later revealed no symptoms and roentgenogram showed minimal pleural thickening

of penicillin instilled. On August 12 and 13 1945 small amounts of pus were obtained and 50,000 units of penicillin instilled on each of these days. Thoracentesis was again attempted on August 14, 15 and 16 but no fluid could be obtained and no penicillin was instilled. Morbidity dropped sharply after the first instillation of penicillin his temperature reaching 98.3 degrees on August 9 1945 and remaining normal from that day until discharge. The original pus was definitely putrid.

**Follow-up** This patient was seen by us on November 12 1946 15 months after discharge and had no complaints except the persistent chronic cough. He was getting regular bronchoscopic aspirations for his bronchial disease. His appetite was good and on physical examination he was well nourished. There was slight impairment of resonance in the left base and impairment of breath and voice sounds. Tactile fremitus was increased in the same area, and a few moist rales were also present at the right base. Physical examination was otherwise essentially negative. Roentgenograms taken on November 12 1946 showed evidence of bilateral bronchiectasis. The pleural disease remained minimal.

**CASE 12** M L female age 20 was admitted to the hospital August 22 1945 discharged September 11 1945. Diagnosis (1) bronchiectasis right lower lobe (2) empyema loculated putrid right, post lobectomy.

The patient had a right lower lobe lobectomy for bronchiectasis in July 1945. Her postoperative course was relatively uneventful, however at the time of discharge a small fluid collection was noted on the right side. At this time the fluid aspirated was sterile. One week before the present admission the patient developed fever chills nausea vomiting and productive foul-smelling cough. She was readmitted for further study. Examination revealed a right-sided scar and slight deformity of a missing rib. There were fine rales posteriorly on the right. Vocal resonance was increased in the interscapular

region down to the seventh interspace but from here to the 12th rib it was decreased. Anteriorly over the right lung fine rales were heard. There was marked tenderness over the lower right chest posteriorly. Roentgenograms August 22 1945 revealed a large empyema on the right. On September 6 1945 the films showed marked improvement and much of the abnormal density in the right lower lung field had disappeared. Considerable pleural thickening was still apparent along the right lateral chest wall but no fluid was present at this time.

The patient was tapped on the day of admission August 22 1945 and 180 cubic centimeters of very thick foul bloody pus were removed with no air. Penicillin 100 000 units was placed in the cavity. The tap was repeated on August 23 24 and 25 1945. The amount of penicillin instilled was 100 000 units on the first two taps and 50 000 units on the last two taps. Systemic penicillin 240 000 units intramuscularly daily was given from August 22 to September 11 1945. Bacteriology showed anaerobic nonhemolytic streptococcus present in the empyema fluid. Cultures were sterile after the second tap.

**Follow-up** This patient was last seen in January 1946 4 months after discharge at which time there was no evidence of recurrence of the empyema. The patient had no complaints and roentgenogram at this time showed the chest to be clear with a minimal amount of pleural thickening at the right base. The succeeding year brought no further symptoms.

**CASE 13** J W male age 29 was admitted to the hospital September 7 1945 discharged October 5 1945. Diagnosis empyema loculated left putrid postlobectomy.

Approximately 6 weeks before admission the patient had a left lower lobe and segmental left upper lobe lobectomy for bronchiectasis. His postoperative course was uneventful. A hydropneumothorax present on the left was aspirated on numerous occasions and all of the fluid was found to be sterile. He was discharged about 1 month previous to this

admission. Shortly thereafter he developed a productive cough and recurring bouts of fever. Examination showed a patient of poor nutrition of pale color and with some degree of exophthalmos. His chest revealed a healed scar of the previous left lower lobe lobectomy. Over the left lower chest the breath and voice sounds were decreased. Moist rales and wheezing were heard over the rest of the left chest. The right chest was clear. Roentgenograms September 8, 1945 revealed a large pleural collection in the left chest posteriorly with evidence of fluid extending from the diaphragm to the seventh interspace. October 4, 1945 (discharge film) showed residual pleural thickening and a small amount of fluid.

The patient was begun on systemic penicillin on September 9, 1945 and continued on it until September 29, 1945 receiving 150,000 units daily intramuscularly. His temperature on admission was 102.2 degrees, with an increased pulse and respiratory rate. This increase returned to normal on the first day of penicillin systemic therapy. Thoracentesis was first done on September 10, 1945, 315 cubic centimeters of slightly odorless pus being removed from the left base and 100,000 units of penicillin being instilled. This dosage was repeated on September 11, 1945 and 100,000 units of penicillin were instilled. Aspirations were again done on September 12, 13, 17, 18, 19, 20, 22 and 24 at which time only 50,000 units of penicillin were instilled. Although the size of the cavity was decreasing according to the amount of fluid and air removed, the cultures persistently revealed a hemolytic *Staphylococcus aureus* throughout all this time. On September 25, 1945 penicillin and a gram of sulfathiazole microcrystals were instilled in the chest after aspiration. Taps were continued on September 27, 28, 29 and 30. Sulfathiazole was again instilled on September 29, 1945 and again on October 3, 1945. On the other taps 100,000 units of penicillin were instilled. The culture became sterile after the tap of September 29, 1945 and remained sterile on September 30, 1945 and October 3, 1945. This organism was found to be only moderately susceptible to penicillin but susceptible to sulfonamides. At the time of discharge, the cavity could not be entered and on the previous tap only 6 cubic centimeters of yellowish nonodorless thin fluid were removed. It is of interest to note that this patient's culture remained consistently positive while on penicillin, but rapidly became sterile on two instillations of sulfathiazole.

Follow-up: Since his discharge film, which was not too satisfactory, this patient has had a good follow-up series with no evidence of an empyema cavity. His sputum volume remained approximately the same but this was attributed to his slight contralateral bronchiectasis. On January 16, 1946 when he was readmitted for removal of nasal polyps the chest was clear and roentgenogram showed no evidence of recurrence of the empyema. He was seen 3 months later on a routine follow-up visit and had no evidence of recurrence.

CASE 14. B. K. female age 58 was admitted to the hospital November 21, 1945 discharged December 22, 1945. Diagnosis empyema, interlobar right, streptococcal postpneumonic.

Two months before admission the patient was treated for right lower lobe pneumonia with sulfonamides and penicillin. The fever continued and the symptoms returned quite severely 1 week before admission. There was a productive cough with reddish brown sputum. Examination disclosed rhonchi throughout both lung fields, percussion note normal throughout, a marked arrhythmia with extrasystoles and a question of gallop rhythm. Roentgenograms, November 23, 1945 showed a sharply circumscribed fluid collection with air above it in the right hemithorax posteriorly just above the lung root. The most likely diagnosis was an interlobar loculated empyema. December 18, 1945 roentgenogram showed marked improvement in the roentgen appearance of the pleural disease with disappearance of the fluid.

The patient was seen in consultation on November 26, 1945 and was placed on systemic penicillin, 100,000 units daily intramuscularly until December 20, 1945 and penicillin inhalations by aerosol four times daily from November 27, 1945 to December 21, 1945. On November 26, 1945 aspiration of 20 cubic centimeters of pus was done and 25,000 units of penicillin were instilled into the cavity. This was repeated three times in the next 11 days, 30,000 units of penicillin being instilled each time. Cultures showed a hemolytic and nonhemolytic streptococcus. These organisms were present in all cultures obtained. However, no culture is available for the last two taps. At the time of discharge the patient was markedly improved clinically.

Follow-up: She was seen in the Out Patient Clinic in August 1946 at which time she had no complaints, no cough, no hemoptysis, and no chest pain. A roentgenogram taken at this time showed no pathology except for accentuation of the upper lower lobe septum on the right.

CASE 15. C. S. female age 27 was admitted to hospital December 3, 1945 discharged May 8, 1946. Diagnosis (1) bronchiectasis, left lower lobe lingula left upper lobe (2) empyema postlobectomy, left putrid multilocular (3) fistula bronchopleural.

This patient had suffered since childhood with a cough which was productive of yellowish purulent sputum. A foul odor was present at times. In the past year the symptoms were more pronounced. She also noted profuse purulent nasal discharge and failure to gain weight. Physical examination revealed an extremely thin and rather tall pallid girl. There was limitation of excursion, dullness and harsh breath sounds in the lower left chest. Bronchograms December 7, 1945 revealed advanced fusiform and sacular bronchiectasis in the left lower lobe and to a lesser degree in the lingula of the left upper lobe.

Lobectomy of the left lower lobe and the lingula portion of the left upper lobe was performed on December 19, 1945 when a rubber tube drain with

negative pressure was placed in the thoracic cavity. This drain was removed on December 23 1945. A thoracentesis was done on December 26 1945 and 240 cubic centimeters of bloody serosanguineous fluid and some air were removed. Repetition on December 29 1945 removed 50 cubic centimeters of serosanguineous fluid. On January 1, 1946 60 cubic centimeters of serosanguineous fluid and 150 cubic centimeters of air were removed. No penicillin was instilled during any of these taps and the cultures were sterile. However the postoperative fever continued with the temperature spiking as high as 103 degrees each day. On January 5 1946 60 cubic centimeters of fetid thick pus were obtained but no penicillin was instilled and culture on this material showed *Hemophilus influenzae*. The tap was repeated on January 6 1946 and 50 cubic centimeters of viscid bloody pus were removed with some air and 50,000 units of penicillin were instilled. On January 7 1946 the tap was repeated a few cubic centimeters of bloody fluid were removed and 40,000 units of streptomycin were instilled. On January 8 1946 40 cubic centimeters of purulent nonodorous material were removed and 50,000 units of streptomycin were instilled. On January 9 1946 30 cubic centimeters were removed and 50,000 units of streptomycin were instilled. This was repeated on January 10 1946 after 50 cubic centimeters of fluid were removed. At this time another cavity was entered anteriorly and cloudy purulent looking material was removed. Culture of this material showed bacilli but no other organisms. This cavity was again entered on January 12 1946 when 35 cubic centimeters of pus were aspirated and 50,000 units of penicillin were instilled. At this time, the fluid from the posterolateral cavity which previously grew the *Hemophilus influenzae* appeared to be sterile grossly and no streptomycin being available none was instilled at this time. On January 13 1946, it was decided that due to the patient's poor clinical response thoracostomy should be done with insertion of drainage tubes. The patient's course following drainage was poor and protracted, her temperature spiking as high as 104 degrees daily at first and gradually returning to normal following two more attempts at more adequate drainage of this multilocular empyema cavity many bronchoscopies and much supportive therapy.

Postoperative roentgenograms showed the development of a multiloculated empyema with a large superior-anterior pocket and a posterolateral pocket. These cavities gradually resolved under open drainage. On April 18 1946 the drainage tubes in the left hemithorax were visible. The left upper lobe appeared to be occupying the remaining space within the left hemithorax. There appeared to be slight increase in the pleural thickening in the axillary region but no fluid collections were seen to suggest an undrained pocket. The patient received systemic penicillin from December 7 1945 150,000 units daily intramuscularly until January 9 1946 when the dosage was increased to 350,000 units intra-

muscularly daily and continued until February 8 1946. Sulfadiazine was begun on January 10 1946 and continued until January 21 1946 6 grams daily by mouth. She was finally discharged on May 8 1946 with obliterated empyema space no symptoms, and normal temperature.

Follow up. This patient has been seen in the Out Patient Department and continues well for 6 months with no evidence of recurrence. Follow up roentgenograms showed no evidence of recurrence of pleural disease.

Of interest in this patient is the multilocular character of the empyema the presence of penicillin resistant organisms in both pockets and the marked difficulty in adequately draining these pockets even by direct operative approach.

CASE 16. J. A. male age 16 was admitted to the hospital February 2, 1946 discharged February 17 1946. Diagnosis (1) empyema loculated left (2) fistula bronchopleural.

The patient was well until December, 1945 when he developed a cough and pains in the chest accompanied by chills and high fever. His family physician diagnosed pneumonia and treated him at home with sulfonamides with moderate but partial improvement. His weakness persisted and his high fever returned about the middle of January with much more chest pain. He was admitted to the hospital for further investigation. Examination revealed the chest symmetrical with a suggestion of lag on the left. There was dullness to percussion in the left lung below the fourth rib anteriorly and below the sixth rib posteriorly. Numerous crackling rales were heard in this area and there were diminished voice and breath sounds. The right lung was clear. Roentgenograms February 4, 1946 revealed abnormal density of the left lower lung field which we believed to be due to a loculated hydropneumothorax. February 14 1946 improvement had occurred and a thin layer of air was seen between the visceral and parietal pleura in the lateral aspect of the left lower pleural space. There was marked thickening of both layers of pleura. The adjacent parenchymal disease was much less.

Systemic penicillin was begun on February 3 1946, 200,000 units intramuscularly daily in two-hourly doses and was continued until February 17 1946. Thoracenteses with aspiration of pus and instillation of 100,000 units of penicillin, were done on February 3 9 11 13 and 14. The initial size of the cavity was 100 cubic centimeters. The material removed was thick and nonodorous. There were no positive bacteriologic reports however one specimen of pleural fluid which was sent to pathology came back with the diagnosis of empyema from the cells and debris which were found. At the last tap on February 14, 1946 only a few cubic centimeters of thin amber-colored fluid were obtained. The sputum volume which had been 600 to 900 cubic

centimeters per day, decreased to 1 to 10 cubic centimeters per day, and the patient rapidly improved.

**Follow up.** This patient was seen 3 months after discharge in the Out Patient Clinic. He had no complaints. Physical examination revealed marked clearing of the left lower chest and the roentgenogram was almost normal. The cavity had disappeared and pleural thickening was minimal. Sputum volume remained zero to 10 cubic centimeters per day. We have had no further contact from this patient.

**CASE 17.** W. D. male age 46 was admitted to the hospital April 6 1946 discharged May 13 1946. Diagnosis (1) empyema, loculated left putrid postpneumonic (2) fistula bronchopleural.

The patient's symptoms began in October 1945, with malaise chills, and fever. He was hospitalized and a diagnosis of pneumonia with pleurisy was made. During the 9 weeks of hospitalization he received numerous thoracenteses with aspirations of fluid. Penicillin systemically was given but not topically. At the end of 9 weeks he was sent to another hospital for bronchoscopy and remained there a short time without a diagnosis being made. He returned home for 3 months on no treatment, and during this time he went progressively downhill with productive cough weight loss chills fever and pain in the chest. Examination revealed a markedly debilitated and emaciated 46 year old white male obviously seriously ill. His color was grayish. He had an old thyroidectomy scar and the trachea was deviated to the right. On the left, expansion was markedly decreased. There was dullness to percussion and the breath and voice sounds were decreased. Roentgenograms April 9, 1946 revealed a large loculated empyema with a fluid level at the left sixth interspace situated posteriorly. There was also what appeared to be a substernal extension of the rod gland into the superior mediastinum. June 27 1946 the pleural loculus previously noted had further decreased. There was pleural thickening throughout the left chest. The upper mediastinal mass was still present. There was stringy density in the left lung root.

On admission this patient was so weak and debilitated he could not move out of bed. His temperature was 101 degrees, his pulse 100 and respiration 30. Thoracentesis of this large loculated pyopneumothorax was done on April 6 1946 the day of admission when 1300 cubic centimeters of foul thick pus were removed from the left pleural space and 100,000 units of penicillin were instilled. This treatment was repeated on April 7, 8, 9, 10 and 12 by which time the size of the cavity was 3 cubic centimeters. On April 14, 16, 18, 21, and 27 large amounts of air were removed but no fluid until the taps on May 3 and 7 1946 when 100 cubic centimeters of fluid and 30 cubic centimeters of air were removed. Penicillin 100,000 units was instilled on each of these taps. No other thoracenteses were done. On culture hemolytic streptococcus intestinal type, was found on the first specimen but no anaerobic

culture was made. All other specimens were sterile. The patient's temperature dropped rapidly to normal after the first tap the size of the empyema cavity decreased rapidly and clinically he improved remarkably. No systemic penicillin was given.

**Follow up.** Two weeks after discharge the patient was readmitted to the Orthopedic Service, and roentgenograms taken at this time showed complete obliteration of the cavity and only residual pleural thickening. He was seen again by us on August 10, 1946 at which time his symptoms were minimal and he was able to return to work.

**CASE 18.** W. A. male age 56 was admitted to hospital May 26 1946 discharged July 9, 1946. Diagnosis (1) carcinoma pulmonary left (2) empyema loculated left.

Symptoms of back pain fever malaise and pain in the left chest had been present since April 6 1946. The patient was treated in a local hospital with penicillin and sulfonamides with some improvement. During this time he had occasional productive cough and some hemoptysis. He was transferred for further study. Examination revealed dullness to percussion and absent breath sounds over the left chest up to the seventh thoracic, with tubular breathing at the apex. The physical examination was otherwise essentially negative. Roentgen-ray examination revealed the following: outside films, the last one on May 4 1946 showed a roughly spherical mass in the extreme posterior portion of the left lower lobe. Admission film on May 28 1946 showed evidence of left lower lobe mass which was similar to that seen on the outside film and had increased in size. There was evidence of fluid in the pleural space.

Aspiration removed 70 cubic centimeters of thick, yellowish nonodoriferous pus, the culture of which grew a pneumococcus which could not be typed. Penicillin was begun systemically on June 1 1946 in the dosage of 30,000 units every 3 hours intramuscularly and continued until July 5 1946. The empyema cavity was tapped and 70 cubic centimeters of pus removed on June 1 1946. Aspiration was repeated on June 2, 3, 4, and 7. At each tap, 100,000 units of penicillin were instilled. On June 1 1946 another tap removed 3 to 4 cubic centimeters of noninfected fluid. No penicillin was instilled. The last thoracentesis attempted was on June 18 1946 at which time no cavity could be found. After the first tap all other thoracentesis material was sterile. A left pneumonectomy was done on June 30 1946. No empyema cavity could be found, and the pleura while thickened showed no signs of active inflammation. The patient's postoperative course was uneventful and he was discharged approximately 3½ weeks following the pneumonectomy.

**Follow-up.** The patient was seen in the office in October 1946. There had been no postoperative infection in the resected side. He was feeling well but roentgenogram revealed extension of the carcinoma to the opposite lung. Since then this patient has expired from widespread metastatic carcinoma.

CASE 19. M. H. age 61 was admitted to hospital July 14, 1946, discharged August 16, 1946. Diagnosis (1) empyema loculated left (2) fistula bronchopleural (3) bronchiectasis upper middle and lower lobes right.

The chief complaint was of cough with blood streaked sputum. He was well until December 15, 1945, when he developed a cold. This persisted for several days until he became acutely ill and was confined to bed for 5 weeks. Weight loss, sepsis and productive cough have continued ever since. On physical examination the temperature was 99 degrees, pulse 115 and respiration 32. The patient was markedly emaciated. There was anterior cervical adenopathy and the trachea was deviated slightly to the right. The lungs were emphysematous and there were diminished breath sounds and tactile fremitus over the right base posteriorly. There was some mediastinal shift toward the right. Roentgenograms July 15, 1946, revealed a large loculated fluid collection in left posterolateral chest with fluid level indicative of bronchopleural fistula. August 1, 1946, bronchogram showed extensive saccular bronchiectasis. August 9, no empyema cavity was visible.

Course. This patient was first seen by the Surgical Department on July 14, 1946, at which time thoracentesis was done and 500 cubic centimeters of thick, nonodorless, greenish yellow pus were removed. In exhaustible amounts of air were also obtained. Penicillin, 100,000 units in 25 cubic centimeters of saline was instilled and systemic penicillin, 300,000 units daily was begun and continued until August 16, 1946. Aspiration was repeated on July 18, 1946 and 500 cubic centimeters of fluid were removed. Evidence of a bronchial fistula was again present. Aspirations were continued on the following days: July 19, 20, 22, 23, and 24, the amount of fluid becoming less and thinner on each of these taps and 100,000 units of penicillin being instilled each time. The taps were continued with instillation of only 50,000 units of penicillin on July 25, 27, 29, 31, and August 2 and 5. At the time of the last tap only 10 cubic centimeters of air and 2 cubic centimeters of thin, clear fluid were removed from the cavity. Clinical response was rapid and marked during these thoracenteses and his productive cough cleared rapidly, his appetite returned and he gained weight. He was strong enough to get out of bed, which he had been unable to do before. None of the specimens of pleural fluid showed any growth. This is interesting since the fluid obtained was grossly pus and for at least six of the taps there was an open bronchial fistula.

Follow up. On October 18, 1946, this patient was well weighed more than he had for a number of years and had returned to work. His chronic cough persisted but this was probably on the basis of his underlying bronchiectasis. A roentgenogram taken on October 18, 1946, 4 months following treatment showed no evidence of pleural disease.

CASE 20. I. R. male, age 56 was admitted to hospital October 29, 1946, discharged November 30, 1946. Diagnosis empyema, loculated right.

This patient had a previous admission on August 16, 1946 and was discharged on September 6, 1946. Three months before the first admission the patient noted a knife-like pain in the right chest which was worse upon breathing or coughing. The cough was productive of greenish sputum and he had some night sweats. Examination revealed decreased to absent breath sounds with dullness below the line of the scapula on the right. Roentgenograms August 16, 1946, showed a bilateral pleural effusion more marked on the right with atelectasis of the right upper lobe out of proportion to the effusion and rounded mass in the right lower lobe area. During this first admission the patient received intramuscular penicillin, 240,000 units daily and thoracentesis on August 19, 1946, removed 20 cubic centimeters of putrid purulent material from the right chest. Penicillin, 200,000 units was instilled. Bacteriology studies revealed many anaerobic nonhemolytic streptococci. On September 5, 1946, aspiration of a few cubic centimeters of similar material without instilling penicillin was done. The patient was discharged on September 6, 1946, with the cavity still present. At the time of his readmission on October 29, 1946, the patient still had fever and a productive cough. On November 1, 1946, the right chest was again aspirated, and 80 cubic centimeters of greenish brown fluid with no odor were removed. Bacteriology report on fluid obtained showed a moderate number of *Streptococcus viridans*. Because of roentgen ray findings of an additional mass in the right chest, surgical consultation was obtained and exploration of the chest was done on November 18, 1946, revealing only diaphragmatic loculus of empyema which was drained. A biopsy of pleura showed no neoplasm. Streptomycin and penicillin were instilled through the tube daily for 10 days, then the tube was removed. Patient recovered rapidly.

Follow up. Up to August 25, 1947, approximately 8 months later the patient was free of symptoms, was gaining weight and had only slight residual right pleural thickening as shown by roentgenogram.

This patient was treated very inadequately for the 3 months prior to his transfer to surgery. Aspiration was done only twice on his first admission and once on his second hospitalization, although small quantities of putrid pus were obtained each time. On the first and third of these penicillin, 200,000 units was instilled. Neither active treatment of the known right empyema or proper proof of the suspected tumor was accomplished. The left effusion was never tapped but disappeared under bedrest, supportive treatment, and systemic penicillin. This case emphasizes the necessity of such patients being treated by the surgeons and is an example of some of the failures reported in other articles.



## SUMMARY AND CONCLUSIONS

The thorough aspiration of pus from empyemas and the reinstallation of adequate amounts of an appropriate antibiotic agent satisfy the basic principles of treatment of this disease namely sterilization and obliteration of the cavity which can be accomplished in most cases and re-establishment of pulmonary function thus decreasing morbidity. In the few instances in which the patient does not react satisfactorily surgical drainage is delayed very little.

In 20 patients treated by us and followed for from 6 to 36 months cure was obtained in 80 per cent while 20 per cent required surgical drainage.

Details of a logical and proved technique are described and the contraindications given.

The literature on the subject is briefly analyzed.

The necessity for proper surgical training in order to treat empyema properly by this or other method is emphasized.

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# THE EFFECT OF STREPTOMYCIN IN EXPERIMENTAL STRANGULATION OF THE BOWEL

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**S**TRANGULATION of the bowel has been for many years both a diagnostic and a therapeutic problem in surgery. The mortality rate is still high despite the value of intestinal suction, restoration of the fluid and electrolyte balance and sulfonamides. In experimental bowel obstruction penicillin has proved to be only moderately effective in prolonging life. Streptomycin is of particular value because it is effective against certain pathogenic bacteria which are not susceptible to the action of other antibacterial substances.

The present study was undertaken to determine what effect if any was exerted by streptomycin upon the course of experimental strangulation of the bowel in rabbits. We were also interested in ascertaining the extent to which bacteria contribute to the damage of the intestine resulting from an inadequate blood supply.

## REVIEW OF THE LITERATURE

It might be helpful at this point to review briefly the literature on the actions of streptomycin as they pertain to the present study. Waksman and his associates (28, 6) have shown that streptomycin is effective against certain gram negative, gram-positive and acid fast organisms. Finland and his coworkers have pointed out that many organisms which at first are sensitive to streptomycin may rapidly become resistant. This fact emphasizes the importance of using streptomycin in doses adequate to produce levels in the tissues and body fluids well above the minimum effective concentration.

The parenteral administration of strepto-

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mycin can result in a therapeutic blood level which reaches its peak in 1 to 2 hours and then gradually falls off. Sixty to 80 per cent of the drug is excreted in the urine in 24 hours (21, 30).

There is no absorption from the stomach or bowel. Although streptomycin is less effective in the presence of acids or acid urine, it is not inactivated by gastric juices (1) and when given orally is excreted almost entirely in the feces. Large concentrations appear in the feces with a considerable reduction of *Bacillus coli* and other organisms generally present there (20, 9). Good concentrations of the drug appear in the pleural and peritoneal fluids, bile, aqueous humor, and the fetal circulation (21, 30).

Streptomycin is polyvalent to a much greater degree than penicillin or sulfonamides and its effectiveness against many strains of organisms of the colon group differentiates it sharply from penicillin (22, 25). Murphy and his colleagues have demonstrated that this property of streptomycin renders it valuable in the treatment of acute diffuse peritonitis caused by a mixture of gram positive and gram negative bacteria.

The extent to which intestinal bacteria contribute to the damage to the intestine produced by an inadequate blood supply has not been clearly demonstrated. The recent work of Poth and his group (12, 14, 15, 16, 17, 18, 19) has shown that sulfasuxidine and sulfathalidine have a powerful antiseptic effect on the intestinal flora. Sarnoff and his coworkers (23, 24) concluded that succinylsulfathiazole conferred a protective effect on a 50 centimeter segment of ileum with occluded venous return by preventing perforation and permitting recovery of bowel integrity.

Harper and Blain (7) observed that in dogs with isolated obstructed, jejunal loops death

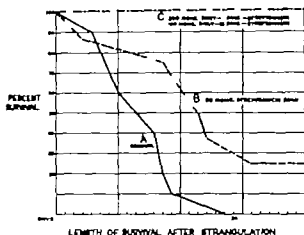


Fig. 1 Effect of streptomycin on mortality rate from bowel strangulation in rabbits.

was due to the action of bacteria or their products, and furthermore that these animals could be protected for a significant period of time with large doses of penicillin. Sulfasuxidine likewise gives protection in dogs with isolated jejunal loops (13-8).

Callihan, Kennedy and Blain (3) emphasized the fact that bacteria play an important part in maintaining the present mortality rate in intestinal obstruction at approximately 20 per cent.

Many investigators (26-27-29) have stressed the significance of hemorrhage in shock accompanying strangulated bowel obstructions. In order to study the precise rôle of bacteria Sarnoff and Fine (23), Blain and Kennedy (2) and others excluded the factor of reduction of the blood volume by treating the shock that developed in their control and experimental animals. While recognizing the significance of hemorrhage and shock, Blain and Kennedy (2) were of the opinion that the bacterial factor was of major importance in causing death from strangulated intestinal obstruction since the survival time was prolonged by penicillin. The prolongation of life however though striking was only moderate. Their control animals died within 36 hours. Seven dogs with the same operation plus massive doses of penicillin survived between 50 and 100 hours. Six dogs lived 70 hours or longer and 4 dogs, 90 hours or longer. In addition they performed intestinal resections on 5 animals at the end of 72 hours which is twice as long as the sur-

vival time for the animals not treated with penicillin and 4 of these animals lived indefinitely.

#### MATERIALS AND METHODS

In the present experiments rabbits were used because as Noer has shown their mesenteric vascular pattern is more similar to that of man than is the mesenteric vascular pattern of dogs. It was necessary to use a method of producing bowel strangulation which would not introduce the factors of hemorrhage shock and intestinal obstruction to complicate the results and render it difficult to determine (1) the exact action of streptomycin upon strangulation unaccompanied by intestinal obstruction (2) the significance of bacterial growth in producing death from strangulation. For these reasons strangulation by devascularization of the small bowel was the method chosen. The first problem was to ascertain the minimum amount of devascularization of the bowel which would cause death in a high percentage of the animals.

Devascularization was performed by ligating the arcuate artery and vein close to the wall of the ileum at two points of varying distances and then ligating all the intervening blood vessels so that the only blood to the devascularized area came through the fine intramural vessels at each end. No attempt was made to suture the mesentery because of its thinness. Fifty-two rabbits were operated upon under ether anesthesia and varying lengths of ileum were devascularized. It was demonstrated (5) that devascularization of 7.5 centimeters of ileum was the smallest length of devascularization associated with a consistently high mortality rate. The average weight of the rabbits in this series was 2 kilograms.

Four groups of rabbits were used. The first was the control series (10 rabbits) in which 7.5 centimeters of bowel was devascularized. The second group (8 rabbits) had 7.5 centimeters of bowel devascularized and each rabbit was given a single daily subcutaneous injection of 80 milligrams of streptomycin for a period of 25 days. The first injection was given immediately after completion of the devascularization operation.



Fig. 2. Gangrene of ileum in untreated rabbit showing site of perforation (bracketed). Note opening in mesentery.

The third group (12 rabbits) had 7.5 centimeters of bowel devascularized and each rabbit was given 200 milligrams of streptomycin daily for 7 days followed by 100 milligrams of streptomycin daily for 21 days, given in the form of two subcutaneous injections daily. The first dose was injected immediately after completion of the operation.

The fourth group (5 rabbits) received 100 milligrams of streptomycin daily by subcutaneous injection for 4 days. They were then subjected to devascularization of the bowel (7.5 cm) and continued to receive 100 milligrams of streptomycin daily for a total period of 25 days.

#### RESULTS

The effects of varying doses of streptomycin upon the mortality rate in experimental strangulation of bowel in rabbits are presented in Figure 1. The control group of 10 rabbits which had not received streptomycin were dead by the nineteenth day after operation. Postmortem examination disclosed that perforation with peritonitis was the cause of death in 80 per cent of these animals (Fig. 2). In the remaining animals death did not appear to be directly related to the devascularization of the bowel.

In the second group of 8 rabbits given 80 milligrams streptomycin daily the mortality was 62.5 per cent 19 days following operation. There was a definite prolongation of survival time in the rabbits in this group. The deaths could be classified as early and late. The early deaths were due to perforation and peritonitis



Fig. 3. Revascularization of strangulated bowel in streptomycin treated rabbit. Note thickening and increased vascularity of mesentery, the opening in which has closed.

in 2 animals. The late deaths in 3 animals resulted from intestinal obstruction produced by kinking of the devascularized bowel. In 1 animal death was not related to the operation. Two animals are still living.

In the third group of 12 rabbits, given 200 milligrams of streptomycin daily for 7 days and then 100 milligrams daily for 21 days more, there has been no mortality after a period of more than 2 months. Five animals were deliberately sacrificed. Postmortem examination disclosed no peritonitis or intestinal obstruction. One animal was alive and apparently well although he had a partial intestinal obstruction.

The changes that take place in the devascularized loops of bowel in those animals which have been enabled to survive by means of streptomycin are of great interest. The 7.5 centimeter loop had contracted to a shorter loop of 5 to 6 centimeters. Blain and Kennedy

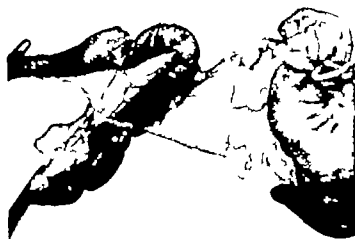


Fig. 4. Revascularization of strangulated bowel in streptomycin treated rabbit. Note adherence of vascular omentum to bowel.

(2, 3) have shown the opposite effect, that is the lengthening of a 60 centimeter segment of ileum to 70 or 100 centimeters when the mesenteric veins were tied. The opening in the mesentery had closed spontaneously. Examination of the devascularized loops of surviving animals showed that the blood supply to the devascularized area came from five sources:

1. Adherent loops of intestine
2. Growth of mesenteric vessels. The hole in the mesentery had closed and blood vessels had grown up to the devascularized loop of intestine. Figure 3 shows blood vessels which have grown past a ligature.
3. The omentum which was frequently found adherent to the damaged loop (Fig. 4).
4. Vascularized adhesions between the parietal peritoneum and the devascularized loop of bowel.
5. Collateral circulation through the intramural blood vessels. In the fourth group of 5 rabbits given streptomycin before and after devascularization there was 1 death on the morning after operation but this was due to a hemorrhagic pneumonia and apparently not related to the experimental procedure. The other 4 rabbits survived. One animal was sacrificed and postmortem examination showed the same type of revascularization of the devascularized bowel present in group 3.

#### DISCUSSION

These results indicate that streptomycin is effective in lowering the mortality rate of rabbits suffering from experimental strangulation of the bowel. If a sufficiently large dose (200 mgm daily) of streptomycin is given there is no mortality. This action of streptomycin in preventing perforation and peritonitis leads us to conclude that in an area of devascularized bowel (strangulation) gangrene and perforation of the bowel are due more to bacterial invasion of the bowel wall than to lack of blood supply alone. The streptomycin by preventing bacterial invasion of the ischemic area, and thus maintaining the anatomical integrity of the bowel wall, allows time for an adequate collateral blood supply to develop.

It is of interest that in some of the rabbits which received smaller amounts of streptomycin (80 mgm daily) the pathologic lesion was

changed rather than eliminated in the sense that it was changed from a bacterial and ischemic gangrene of the bowel wall to a mechanical obstruction due to kinking of the bowel.

In some respects the bowel lesion produced in these experiments is comparable with acute arterial mesenteric thrombosis or embolism which occurs in human beings. In this condition and in other lesions of the bowel in which there occurs a combination of inadequate blood supply and bacterial invasion of the tissues—for example after operative release of a strangulated hernia or after intestinal suture or anastomosis when the vascularity of the tissues at the site of suture is in doubt—the administration of streptomycin may on the basis of the results of the present study prove to be of value.

Finally the question must be asked: How does the streptomycin reach the bacteria present in the devascularized area? There are two possible ways in which this could take place: (1) The streptomycin is secreted into the intestinal tract in effective concentration from the blood stream. It has been shown that streptomycin administered parenterally is not excreted into the intestine. In our experiments streptomycin was not administered orally. (2) The streptomycin is carried in the blood stream along the collateral blood vessels which run from the normal bowel into the devascularized area. This is the probable route. We have shown elsewhere (5) by injection studies that the intramural vessels remain patent and carry blood into the devascularized area of bowel.

If this explanation is correct, namely that the action of streptomycin in bowel strangulation depends upon its being carried to the strangulated area by the blood stream, it follows that the more extensive the area of strangulation the less likely is streptomycin to prove effective in preventing bacterial gangrene and perforation of the bowel wall. In a paper which will be published elsewhere (5) we have shown that the length of survival is directly inverse to the length of strangulated bowel. This would mean that the more extensive the strangulated loop the shorter would be the period of survival and therefore less

time would be available for the streptomycin to exert a beneficial effect.

These facts have a direct clinical application. Since it is usually impossible to predict before operation the extent of strangulation which is present, it would be dangerous to depend upon streptomycin alone even in patients with mesenteric thrombosis. It is clear that streptomycin should be regarded as an adjunct to rather than as a substitute for surgery in strangulation of the bowel.

### CONCLUSIONS

The administration of streptomycin in doses of 80 milligrams (40 mgm per kilogram of body weight) daily lowered the mortality rate and in doses of 200 milligrams (100 mgm per kilogram of body weight) daily prevented any mortality in rabbits subjected to experimental strangulation of bowel by devascularization.

Bacterial growth in the devascularized bowel wall was the major factor leading to perforation and gangrene of the bowel. Prevention of the growth of bacteria by streptomycin was the mechanism underlying the prolongation of life in the treated rabbits in these experiments.

On the basis of the results obtained in our study it is suggested that in human beings the administration of streptomycin might be a useful adjunct in the treatment of strangulated intestinal obstruction particularly the type due to acute arterial mesenteric thrombosis or embolism. Streptomycin should be given in intestinal obstruction when strangulation is suspected. It is suggested that the therapeutic value of streptomycin is dependent upon the length of strangulated bowel. Since it is impossible to predict the extent of strangulation streptomycin should be regarded as an adjunct to and not as a substitute for surgery.

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### III BURIED EPIDERMIS GRAFT

ERNEST BORS M.D., and ALISTIN COMARR M.D. Van Nuys, California

THE purpose of this paper is to revive an old yet simple and efficient method of skin grafting and to discuss its application to the problem of the treatment of bedsores in patients suffering from paraplegia. The procedure has been used for more than 2 years (F. B.) in selected decubitus ulcers. The last series of more than 50 patients treated during the past year form the basis for our observations.

The procedure is known as the Implantation Method of Skin Grafting (Wangensteen). Originated by Braun (3, 6) in 1920 it was applied by Wangensteen for the first time in 1928. In 1930 he reported the technique, indication and result in 60 cases. The series included cases of infection, osteomyelitis, emphysema, avulsions, decubitus ulcers and burn. As we have been familiar with the method since 1929 it seemed that we were justified in using it on a larger scale in treating decubitus ulcers in the presence of spinal cord injuries.

The sores treated were situated on the sacrum, trochanter, knees, ankles, ischium, dorsum and iliac spine. The purpose of the grafting was twofold: first to achieve permanent closure of the ulcer and second to provide temporary epithelialization in order to restrict the loss of protein until a permanent plastic flap procedure could be attempted. The use of buried epidermis as a permanent graft has definite value in cases in which plastic procedures cannot be executed. The method is well suited for the treatment of ulcers of the heels, ankles and knee caps.

The preoperative management is similar to though less complicated than the routine preparation for plastic closure of decubitus ulcers. It consists of maintaining the protein balance (14) and correction of anemia (11). Also wet dressings of Dakin's or Domboro's

solution are applied locally to the area involved to enhance good granulation. Better granulation tissue provides a better medium for the seeds to develop in. Wangensteen's observation, however, confirms the fact that there is a surprising number of "takes" even when the seeds are implanted in a poor host.

The technique (Fig. 1) is essentially the same as that described by Braun and Wangensteen. After routine preparation of the donor site with ether and alcohol, saline solution is used to keep the skin surface wet. With a Fergus Smith or amputation knife a thin Thiersch graft is removed in one piece. Its size depends on the number of grafts needed. The graft is then divided on a wooden board with a Parker knife into small squares of 0.3 by 0.3 centimeter. An instrument is used to drill holes into the granulation tissue at an angle of 35 degrees. The grafts are introduced into the preformed bed where they are retained after withdrawal of the instrument. Instead of the instrument, straight needles can be used as described by Wangensteen. It is best to implant the seeds first into the lowermost row of the field. This step will keep the operative area free of blood. Even the slightest unavoidable hemorrhage from burrholes tends to blur the field if grafting is started on top. The grafts are placed 1 to 1.5 centimeters apart. The grafted area is covered with dry fibrin foam and then dressed with equal parts of furacin and boric acid ointment. A firm bandage is applied for 5 to 7 days. The dressings are changed every other day. Should pyocyanous infection develop despite the prophylactic use of boric acid ointment, acetic acid wet dressings will readily eliminate it. We keep the patient in bed for 48 hours although Wangensteen has applied the method successfully in ambulatory patients. At the end of the first and beginning of the second week grayish islands (Fig. 2) of epithelium appear at the site of the seeds. The patches coalesce rapidly and granulation tissue retracts. If barren spots remain, regrafting can be at

From the Paraplegic Service of Birmingham Veterans Administration Hospital, Van Nuys, California.  
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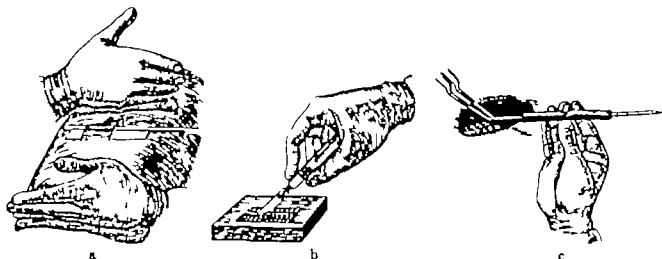


Fig 1 a Method of obtaining Thiersch graft from surface of thigh b, method of dividing Thiersch graft into seeds c, method of implanting seeds.

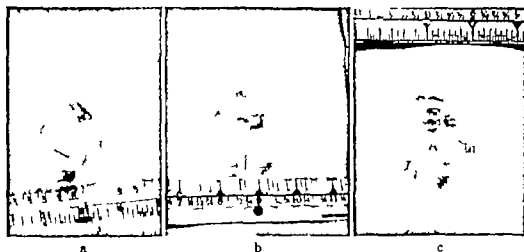


Fig 2 a Before grafting b 15 days after grafting c, 28 days after grafting

tempted at any stage after the first 10 days. Complete epithelization will take place in from 3 to 6 weeks depending on the size of the defect.

We concur with Wangenstein's statement that the cosmetic result has not been above criticism and we also agree with him that this disadvantage is outweighed by the many advantages. The chief advantages are (1) the simplicity of the method (2) the great number of 'takes' ranging from 50 to 70 per cent (3) the resistance of the implants to infection and extrinsic damage—even where breakdown occurs quick regeneration ensues from the seeds (4) the thriftiness of the method—the donor area in other words the size of the Thiersch graft need be only 6 to 8 per cent of the size of the defect to yield sufficient seeds to bring about healing.

Comparison of the resulting skin with that obtained by marginal epithelization showed it to be firmer and stronger. Under gentle massage the skin revealed a tendency to become mobile. The reason for that might be an imitation of true skin by the seeds (4) which tend to push their epithelium along the cleft created by the implantation. On histologic examination berrylike structures were described (15) consisting of a nucleus of cutis enveloped by a shell of epidermis. This too undoubtedly accounts for easy regeneration.

All these advantages more than outweigh the criticism that the cosmetic results are inferior and that the quality of the resulting skin is inferior to that obtained with plastic flap procedures. It is our opinion, therefore, that in all cases of decubitus ulcer where free skin grafting appears to be indicated the 'buried



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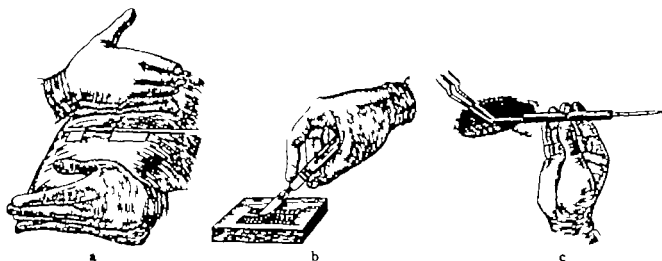


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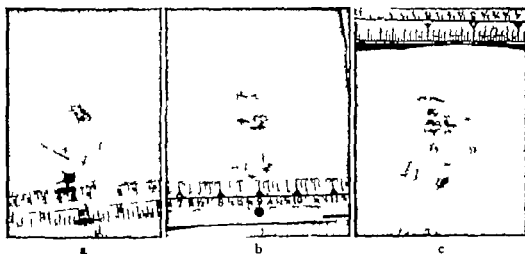


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epidermis graft is far superior to any other type of free skin graft

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# THE TREATMENT OF CONGENITAL (OR DEVELOPMENTAL) COXA VARA

THOMAS HORWITZ, M.D. F.A.C.S. Indianapolis Indiana

ONE must conclude from a critical review of the literature that the treatment of congenital coxa vara is not too well defined. There are those who recommend a period of conservative treatment prior to surgery. It appears logical to these authors (2-10) that protection from direct weight bearing in unilateral cases and the avoidance of the upright position in bilateral cases may lessen the deforming effects which weight bearing and muscle tension have upon the disorganized femoral necks in these cases. Although they report no group of patients so treated, they draw attention to the fact that spontaneous correction has been observed to occur in other types of juvenile coxa vara, for example the rachitic type and also to the fact that a mild varus deformity of the neck of the femur is consistent with good function (Fig. 1).

However, most authors believe that there is no justification for awaiting spontaneous ossification prior to osteotomy and they advise immediate surgical intervention (3). In this latter group there are those who favor (12) and those who advise against (4, 5, 9) drilling or introduction of a bone peg through the femoral neck and epiphysal plate region for purposes of 'revascularization and revivification' prior to or at the time of corrective osteotomy. Those recommending osteotomy alone point to the fact that overcorrection of the neck deformity to a degree of coxa valga, so as to bring the plane of the capital epiphysal line nearer to the horizontal, has been followed by spontaneous maturation of the epiphysal plate in their patients.

The present investigation is based upon 17 cases of the congenital or developmental type of coxa vara, and it has as its purpose an

evaluation of the results following a variety of surgical procedures. The ages of the 17 patients ranged from  $3\frac{1}{4}$  to 21 years at the time of first operation. In 8 patients the condition was bilateral and in 9 it was unilateral.

## ANALYSIS OF CLINICAL MATERIAL

The clinical data in the 17 cases of congenital (developmental) coxa vara have been incorporated in Table I. Results were interpreted as being good when pain was relieved, limp and a positive Trendelenburg test lessened or disappeared, the normal lumbar lordosis was restored, the range of abduction of the hip joint was increased, and there was restoration of some or all of the length of the affected extremity. The roentgenograms in these cases revealed a restoration of the normal neck shaft angle of the femur. Such results were obtained in 2 cases, one being unilateral and the other being bilateral. Fairly satisfactory results as judged from the facts that some residual deformity and disability persisted postoperatively, often with incomplete correction of the coxa vara deformity on the roentgenogram, were obtained in 4 cases, 2 being unilateral and 2 being bilateral. The results in the remaining cases have been classified as poor.

## DISCUSSION

The postoperative results in the 17 cases of congenital coxa vara herein reported have not been uniformly satisfactory after any one method. However, they have been more consistently satisfactory, with a lesser incidence of immediate postoperative complications following subtrochanteric osteotomy than by any other procedure. The poorest results have followed the intra-articular procedures.

The appearance of late complications, such as deformity of the femoral head and degenerative arthritis of the hip joint, was related

From the Laboratory Division, Hospital for Joint Diseases, New York, Henry L. Jaffe, M.D., director. Work done under a Frederick Brown Research Fellowship in Orthopedic Surgery.

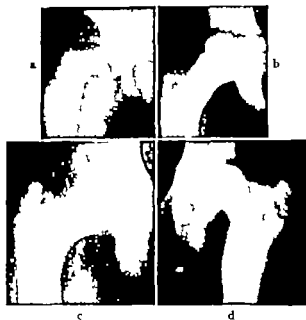


Fig. 2.

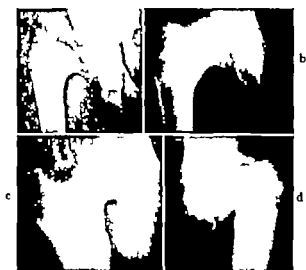


Fig. 3.

Fig. 2. a, Anteroposterior roentgenogram of the right hip joint in a 1-month-old colored boy with bilateral coxa vara deformity on a rachitic basis. b, Roentgenogram of the same hip 6 years later during which period the child received no orthopedic treatment, shows an overcorrection of the femoral neck deformity with the development of slight coxa valga. A similar spontaneous correction occurred on the left side. c, Roentgenogram of the right hip joint in an 1-year-old male demonstrating open epiphyses and moderate coxa vara deformity. There has been surgical intervention on this side and the function is excellent. d, Roentgenogram of the left hip joint in the same case as (c) 10 years after drilling operation and subtrochanteric osteotomy. The capital and greater trochanteric epiphyses are closed and the coxa vara deformity is fairly well corrected. Function is excellent and there is only a slight limp on this side.



Fig. 3.

Fig. 3. a, Right hip joint of a 7-year-old colored female. There is a marked congenital coxa vara deformity and the region of the vertically placed epiphyseal plate and of the adjacent femoral neck shows considerable disorganization. The projecting inferior lip of the femoral neck could be misinterpreted as representing the inferior portion of a displaced capital femoral epiphysis. b, Same hip joint as in a, 15 years following subtrochanteric osteotomy. The functional result is poor, there being residual limp and considerable loss of motion. The roentgenogram shows a residual coxa vara, and mushrooming of the capital epiphysis with narrowing and irregularity of the joint space superiorly. c, Hip joint of a 31-year-old girl with severe bilateral coxa vara deformity 9 years after a subtrochanteric osteotomy. The femoral head is somewhat mushroomed and the joint space is narrowed superiorly. d, Roentgenogram of the right hip joint in the same patient as (c) 15 years after Whitman reconstruction operation for a marked congenital coxa vara deformity demonstrates very advanced degenerative arthritis of the hip joint.

Fig. 3. a, Roentgenogram of the left hip joint of a 7-year-old boy 1 year after replacement of the capital epiphysis on the femoral neck with a bone peg. The capital fragment has collapsed and there is severe distortion of the remains of the femoral head and neck. Clinically the hip joint was ankylosed with flexion-adduction deformity which required subtrochanteric osteotomy. b, Right hip joint in a 7-year-old colored female in whom the bony structures are remarkably well developed. The coxa vara deformity is severe, the inferior border of the femoral head reaching below the level of the lesser trochanter. The femoral neck is somewhat foreshortened, and its inferior beak projects sharply downward as far as the inferior tip of the capital epiphysis.

(Continued on next page)

not only to the severity and duration of the coxa vara deformity and to the age of the patient, but, in some of the cases to the surgical intervention. These complications occurred not only following intra articular procedures (Figs. 2 b and 3 a) but followed a combined drilling subtrochanteric osteotomy with revision of the greater trochanter in one case (Fig 3 c and f) and subtrochanteric osteotomy in 3 cases (Figs. 2 a, b d and 3 b c, and d). It is apparent from the writer's material, therefore, that a good clinical result immediately postoperatively is no assurance against the development of secondary degenerative changes in the hip joint later in life. Nevertheless, these changes will certainly appear and at a much earlier age (as early as 15 years in one case in the writer's material) if no effort is made to correct the mechanical disturbance incidental to the coxa vara deformity.

Discussions relative to the technical problems involved in performing a subtrochanteric osteotomy and underlying the rationale of drilling as a procedure directed to revascularizing and revivifying osseous tissue and with reference to the treatment of cases in which a severe degenerative arthritis of the hip joint dominates the clinical picture require special consideration.

The vertical epiphyseal plate and the metaphysis appear fairly well organized. c, Excellent correction of the coxa vara in the case illustrated in, b after subtrochanteric osteotomy. The epiphyseal plate is still visible. d, Roentgenogram of the hip joint in c, 1½ years postoperatively, demonstrates marked alteration in the head and neck of the femur. The bone is markedly densified the neck is broadened due to the deposition of bone on its superior surface, and the head is deformed and its articular surface is irregular. e, An advanced stage of coxa vara deformity in a 14 year old male with unilateral involvement. The neck is markedly foreshortened and the inferior portion of the femoral head is placed opposite the lesser trochanter where it appears to be attached directly to the femoral shaft. There is an irregular radiolucent band between the femoral head and the remains of the disorganized neck, which might be misinterpreted as a site of pseudarthrosis or non union. f, Roentgenogram of the hip joint in the case illustrated in, e, 5 years following a drilling of the neck of the femur subtrochanteric osteotomy and excision of part of the greater trochanter. The immediate correction of the coxa vara was very good, and, in fact, this roentgenogram demonstrates the outlines of the head and neck in the corrected position. There has occurred however an enormous deposition of bone about the femoral neck, particularly at the upper pole of the resected greater trochanter. The femoral head is mushroomed and its articular surface is irregular.

TABLE I—CLINICAL DATA IN 17 CASES OF CONGENITAL COXA VARA

Operation	Age	U (Unilateral) or Bilateral	Result	Remarks
Subtrochanteric osteotomy	3½	Bilateral (rt.)*	Good	Follow-up 4 years. Drilling osteotomy on left
	11	Bilateral	Fair	Follow-up 4 years
	6½	U (lateral)	Fair	Follow-up 1 year
	7	Unilateral	Poor	Required second osteotomy with fair result
	6	Bilateral	Poor	Pseudarthrosis followed second osteotomy
	7	Bilateral	Poor	Required second osteotomy
	7	Bilateral (rt.)*	Poor	Partial ankylosis of right hip joint. Drilling osteotomy on left
	8	Bilateral (left)*	Fair	Observed 9 years post operatively. Reversing degenerative joint changes. Whitman operation on right
Drilling of femoral neck and subtrochanteric osteotomy	5	Unilateral	Good	Two stage operation. Follow-up 3 years
	1½	Bilateral (left)*	Good	One stage operation. Follow-up 4½ years
	9	Bilateral	Fair	One stage operation, with removal great trochanter. Follow-up years
	5½	Unilateral	Poor	Required second osteotomy with good correction. One stage
	7	Bilateral (left)*	Poor	Partial ankylosis of hip joint. One stage
	5	Unilateral	Poor	Two stage operation. Loss of control of fragments and adduction contracture of hip joint
	14	Unilateral	Poor	Follow-up 8 years. Fair but hip due to degenerative arthritis
Bone graft and subtrochanteric osteotomy		Unilateral	Poor	Required second osteotomy. No follow-up
Bone peg with reposition of femoral head	7	Bilateral	Poor	Left side only. Postoperative infection resulted in ankylosis of both hip joints
Bone peg through head and downward shift of great trochanter	7	Unilateral	Poor	Ankylosis of hip joint with flexion-adduction deformity
Whitman operation	5	Bilateral (rt.)*	Poor	Follow-up 5 years. Pain and disability
Resection of portion of epiphyseal plate	6	Unilateral	Unknown	Epiphyseal dysplasia. Fusion obtained. Did not return for subsequent osteotomy

\*Bilateral cases with different operations on each side

**Subtrochanteric osteotomy** On theoretical grounds a postoperative recurrence of coxa vara deformity might be anticipated in a young patient whose roentgenograms demon-

strate a highly disorganized epiphyseal plate and femoral neck at the time of osteotomy because of progressive activity of this underlying lesion. Recurrence of varus deformity was observed in this study in 4 patients whose ages ranged from  $5\frac{1}{2}$  to 7 years. However this complication was observed immediately or shortly after operation in all instances and was due to inadequate or improper control of the postosteotomy fragments. Indeed the fact that progression of varus deformity did not occur in the femoral neck once union occurred following subtrochanteric osteotomy, and that the epiphyseal plate regions appeared to mature spontaneously in these cases lends support to those who advocate subtrochanteric osteotomy alone without supplemental drilling of the femoral neck in the treatment of congenital coxa vara.

Recurrence of the varus deformity immediately following subtrochanteric osteotomy is due to certain mechanical difficulties encountered in the control of the postosteotomy fragments. When a subtrochanteric or intertrochanteric osteotomy is performed in the presence of an ankylosed hip joint, the position of the femoral fragments is easily controlled by adequate external fixation (plaster of paris) because the short proximal fragment is fixed. When such an osteotomy is done in the presence of a movable hip joint it may be difficult to control the proximal fragment the head and neck rotating as the distal fragment is abducted (8). This difficulty prevails whether the osteotomy is transverse or oblique with or without excision of a lateral wedge of bone or is curvilinear V, L- or Z-shaped, procedures designed to prevent displacement of the osteotomy fragments. Furthermore in order to correct a varus deformity of 90 degrees or less the thigh would have to be abducted to a position in relation to the fixed pelvis which is impossible except in very young infants because of the restricting ligaments and adductor muscles, unless so much bone is sacrificed as to jeopardize control of the femoral fragments and to encourage increased shortening (9).

To obviate these difficulties the long axis of the proximal femoral fragment should be maintained in its proper relation to the pelvis

leaving the abnormal relation of the femoral shaft to the neck to be corrected by bringing the major distal fragment into the necessary degree of abduction. Control of the proximal femoral fragment may be secured by the use of a stainless steel pin incorporated in the plaster of paris encasement or stainless steel pins or Schanz screws in both fragments may be fixed to each other by a Riedel plate or some modification thereof and incorporated in the plaster encasement (9). On the other hand the femoral fragments may be fixed to each other internally by the use of a Blount or Moore type of metal plate (1). A well-leg traction apparatus may be used after osteotomy to control the distal fragment by traction in cases in which the hip joint is mobile and particularly where the contracted soft tissues and muscle spasm prevent immediate correction of the deformity (8, 11).

*Drilling of or implantation of a bone peg through the femoral neck.* The rationale of drilling the femoral neck or introducing a bone graft through it into the head as measures to revascularize and revivify bone as recommended for example, in the treatment of degenerative arthritis of the hip joint, has not been sustained by clinical experience (6) or by the writer's histologic studies. Histologic sections from the femoral head in several cases of degenerative arthritis of the hip joint and of Perthes' disease treated by multiple drillings indicate that these drill holes persist for years, become filled with connective tissue, and in no way modify the progress of these disease processes. Nor is it clear how a piece of transplanted bone, avascular in itself will aid in the process of revascularization.

*Treatment of secondary severe degenerative arthritis of the hip joint.* Cases with severe coxa vara of long duration pose the additional problem that a good surgical correction of this deformity may fail to effect a satisfactory functional result in the presence of secondary degenerative changes in the femoral head and hip joint. The use of arthrodesis in unilateral cases and of vitallium cup arthroplasty or resection of the femoral head in bilateral cases as discussed by the writer for the treatment of degenerative arthritis of the hip joint (7) would appear to apply also to the late cases.

# CONCLUSIONS

1 This investigation is based on 17 cases of congenital or developmental coxa vara. This deformity should be suspected in any child who manifests a painless limp. Pain which appears in adolescence and in the adult is dependent on the degree of deformity and shortening, and upon the extent of degenerative changes which affect the hip joint largely on a static basis. The roentgenograms and histologic studies in these cases show a pronounced disorganization of the femoral neck in the region of, and distal to the epiphyseal plate, the exact nature of which is not clearly understood.

2 An evaluation of the results of surgery in these 17 cases of congenital or developmental coxa vara fails to justify the use of drilling of, or introduction of a bone graft through the femoral neck as a procedure supplemental to corrective osteotomy. The results have been satisfactory more consistently with a lesser incidence of immediate postoperative complications, following simple subtrochanteric osteotomy than by any other method. Recurrence of coxa vara deformity after subtrochanteric or intertrochanteric osteotomy in 4 cases was due to mechanical difficulties involving control of the postosteotomy fragments, particularly in the presence of a movable

hip joint. A good surgical correction may be vitiated in cases in which the coxa vara deformity has been of long duration and the follow up period sufficiently long, as a result of the appearance of secondary degenerative changes in the femoral head and hip joint.

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# THE EFFECT OF TETRA-ETHYL AMMONIUM CHLORIDE ON GASTRIC SECRETION AND ACIDITY IN PEPTIC ULCER

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THE excessive secretion of acid gastric juice at night when the stomach is empty of food has been shown by Dragstedt to be a major contributing factor in the origin and particularly in the continuing activity of peptic ulcers. He has further shown that the amount of free stomach acid and the volume of the night gastric secretion are excessive in patients with peptic ulcer as compared with normal persons or patients with other diseases. To decrease this night secretion Dragstedt (4 5 6) devised an efficient method of sectioning the vagus nerves to the stomach. This operation has proved to be effective in its purpose. Following complete section of both vagus nerves a marked decrease in the secretion of acid gastric juice has been uniformly observed. Unfortunately however the effects of vagus section have not been entirely beneficial. Grimson (9) Moore (8) Walters (10) and other experienced observers have reported postoperative gastric atony dysphagia bouts of diarrhea, and certain other unpleasant gastrointestinal manifestations.

Because of these unfortunate effects of vagus section it occurred to the author that a method of temporary vagal block might effectively decrease the excessive night gastric secretion in the patient with peptic ulcer without interfering with vagal function during the day when acid gastric juice and peristaltic activity are needed in the processes of digestion.

The published investigations of Acheson Moe Lyons and their co-workers (1 2 3 7) indicate that tetra-ethyl ammonium salts produce an effective block of all autonomic nerve impulses, both sympathetic and parasympathetic, and that this block occurs at the auto-

nomic ganglia. One of the many effects of this block is reported to be a decrease in gastrointestinal motility and in the volume and acidity of the gastric juice.

With these preliminary thoughts, an investigation was undertaken to determine whether the excessive night secretion in patients with peptic ulcer could be prevented by vagus nerve block with tetra-ethyl ammonium chloride (etamon). In evaluating the results of this investigation it must be kept in mind that the block produced by etamon is not a pure vagal block but a combination of vagal plus sympathetic block.

Sixteen patients with peptic ulcers proved by x ray examination or gastroscopy were selected at random from the hospital wards. Eleven of these patients had duodenal ulcers, 3 had marginal ulcers at the sites of previous gastroenterostomies, 1 had a gastric ulcer and 1 had multiple gastric ulcers. One of the patients with duodenal ulcer was tested twice (No. 10 in Table I) and he subsequently proved at operation to have a giant follicular lymphosarcoma of the stomach in addition to a duodenal ulcer. In the cases of marginal ulcer the measurement of the 12 hour secretion is less reliable because of the presence in each of these cases of a gastroenterostomy.

The following schedule was carried out on each patient.

The usual hospital supper was given at 5:00 p.m. Nothing by mouth was allowed thereafter until the completion of the gastric drainage on the following morning. At 8:30 p.m. a gastric lavage was done through a large caliber tube until the return was clear. Continuous nasogastric suction was then carried out from 9:00 p.m. to 9:00 a.m. The total 12 hour volume of the suction drainage was measured and determinations of the free and total acidity were made.

On the succeeding night the same procedure was repeated with the added factor of intra-

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TABLE I—TWELVE HOUR NIGHT GASTRIC SECRETION AND ACIDITY

Patient	Intramuscular etamon dosage		Without etamon			With etamon		
			Volume in c.c.	Units of free acid	Units of total acid	Volume in c.c.	Units of free acid	Units of total acid
	Align of etamon per kg of body weight	Interval of administration	6.90	75 (Five hour secretion)	3	200 (Five hour secretion)	20 (Five hour secretion)	20
1. K.H.	20.5	One dose						
2. L.P.	8.0	Every 6 hours		78	02	270	24	46
3. E.L.	19.0	Every 6 hours	1026	9	34	1000	3	18
4. D.R.	20	Every 6 hours	368	6	3	50		20
5. J.M.	20	Every 6 hours	750	20	48	0		11
6. C.T.	20.6	Every 6 hours	475		33	360	19	43
7. C.L.		Every 6 hours	520		3	460	48	70
8. N.A.	21	Every 6 hours	500	73	107	690	47	106
9. L.H.	21	Every 6 hours	1000	35	60	590	0	34
10. E.T.	21	Every 6 hours	545	30	85	590	5	37
11. H.J.	21	Every 6 hours	600	4	40	400	0	30
12. A.M.	21	Every 6 hours	875	50	90	680		23
13. M.G.	21	Every 6 hours	1000	5	40	5	1	44
14. K.B.	21	Every 6 hours	1450	30	53	400	20	61
15. A.L.	21	Every 6 hours	550	3	53	345	8	27
16. A.S.	21	Every 6 hours	740	26	5	42	13	35

muscular etamon The doses of etamon varied from 17.9 to 21.6 milligrams per kilogram of patient's body weight. The doses were given at 6 hour intervals (at 9:00 p.m. and 3:00 a.m.) in 8 patients, and at 4 hour intervals (at 9:00 p.m., 1:00 a.m., and 5:00 a.m.) in 6 patients. One patient was tested twice once at 6 hour intervals and once at 4 hour intervals. The first patient was tested for 1 night only drainage being obtained for 5 hours without etamon and for 5 additional hours following a single dose of etamon.

The etamon dosage employed and the results of the investigation are shown in Table I.

Very few side effects of etamon were noted—all were transient and none was serious. Among these side effects were blurring of vision in 2 patients, a 'shaky' or 'jumpy' feeling in 1 patient, and a temperature of 101.6 degrees with moderate cellulitis of both buttocks at the injection sites in 1 patient. Blood pressure readings were checked in about half the cases and there was always a drop about 1 hour after each dose of etamon. This drop varied from 7 to 34 points in the systolic pressure and from 2 to 22 points in the diastolic

pressure. This drop was transient and the pressure returned to normal within 3 to 4 hours.

#### SUMMARY

Effective reduction of the 12 hour night secretion or acidity or both was accomplished in 12 out of 17 gastric drainage tests done with the administration of intramuscular etamon. Two tests failed to effect a significant reduction in either secretion or acidity. 2 other tests resulted in a significant decrease in the volume of secretion but a rise in the levels of both free and total acid while another test showed no change in secretion but a definite decrease in the free and total acidity.

Nine tests were done with etamon given at 6 hour intervals. Of these, 1 did not show a significant decrease in secretion or acidity, 2 showed a decrease in secretion but an increase in acidity and 1 resulted in decreased acidity but an unchanged volume of secretion.

Seven tests were done with etamon dosage at 4 hour intervals, and only 1 failed to show a decrease in secretion or acidity. The diagnosis of marginal ulcer in this last patient was not clear cut.

In 1 case a marked decrease was exhibited in both secretion and acidity for the 5 hours following a single dose of etamon.

The slight variation in the milligram dosage was dictated by the necessity of measuring the dose in cubic centimeters for injection. No difference in results could be attributed to this slight variation which was present in the milligram dosage.

In determining the adequacy of the dosage interval it is of interest that Case 10 was tested twice—once at 4 hour intervals and once at 6 hour intervals. This patient showed a poor response to etamon dosage at 6 hour intervals but a very good response when the dose was repeated at 4 hour intervals.

#### CONCLUSIONS

1 Tetra-ethyl ammonium chloride (etamon) prevented excessive night gastric secretion and acidity in 12 out of 17 tests of patients with peptic ulcer studied.

2 Intramuscular etamon dosage of approximately 20 milligrams per kilogram of body weight is usually adequate to produce the above effect if repeated at intervals of 4 hours but is not uniformly adequate at intervals of 6 hours.

3 When etamon was given at 4 hour intervals, excessive night gastric secretion and acidity were inhibited in 6 out of 7 patients with peptic ulcer.

4 No serious toxic or side effects of etamon were noted.

5 Transient fall in both systolic and diastolic blood pressures was noted after etamon administration.

6 Therapeutic trial of the effect of etamon on the symptoms and healing of peptic ulcers is warranted and will be undertaken.

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# TRANSITION OF PANCREATIC EDEMA INTO PANCREATIC NECROSIS

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**T**HE usual pathogenetic mechanism of acute pancreatitis in man is a block at the papilla of Vater in the presence of a common channel between common bile duct and pancreatic duct. This block caused either by stone or by spasm will lead to stagnation of pancreatic juice and of bile in the common channel. The subsequent increase of pressure in the duct system and the intraductal activation of pancreatic juice are considered to be the causes of acute pancreatitis.

The authors have demonstrated the presence of a common channel in 89 per cent of a series of cases of pancreatic edema, of acute pancreatitis and of pancreatic necrosis (3). This finding together with the observation that transition of pancreatic edema into acute pancreatitis occurred not so rarely made us feel that basically, these processes were not different. Why, however, in some cases edema of the pancreas would develop and in others hemorrhagic necrosis remained to be answered.

After we had succeeded in producing experimentally an extensive edema of the pancreas under conditions resembling physiologic processes (4) the question arose how this same mechanism would lead to the development of pancreatic necrosis. Our method of producing pancreatic edema consisted in stimulation of external pancreatic secretion by intravenous injection of a large dose of secretin after ligation of the main pancreatic duct or of the main and accessory ducts. Though this procedure rarely failed to produce edema of the pancreas it never caused pancreatic necrosis.

Similar experiments with stronger and more prolonged stimulation of pancreatic secretion by constant intravenous infusion of secretin solution over several hours, or by repeated

administration of large doses of secretin at short intervals over a period of several hours did not lead to pancreatic necrosis.

We had felt heretofore, that pancreatic edema and acute pancreatitis were probably different reactions to or different degrees of the same process. However, the observation that secretin produced edema only and never produced pancreatitis suggested that an additional factor was necessary to transform pancreatic edema into pancreatitis or pancreatic necrosis.

The following procedures designed to transform pancreatic edema into pancreatic necrosis, gave negative results. Ligation of the cysterna chyli in order to block lymphatic drainage from the pancreas, temporary clamping of the portal vein, shock produced by trypsin or by gross trauma. However temporary occlusion of the main pancreatic (gastroduodenal) artery performed in animals with edema of the pancreas, led to the development of pancreatitis. In order to make sure that this occlusion of the pancreatic artery by itself would not cause necrosis of the pancreas preliminary control experiments were performed which showed that this procedure applied for 30 to 45 minutes in a normal dog was not followed by gross or microscopic changes of the pancreas.

## METHODS

Seventeen healthy mongrel dogs of both sexes, weighing between 9 and 13 kilograms were used. The animals were anesthetized with pentobarbital sodium and aseptic technique was used throughout operation. In 10 dogs edema of the pancreas developed following secretin injection and the main pancreatic artery was occluded for 15 minutes. The remaining 7 dogs served as controls: (a) without pancreatic edema, arterial occlusion was performed after ligation of the pancreatic duct or after injection of secretin, (b) with pancre-

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4. No serious toxic or side effects of etamon were noted.

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Aided by a grant from the A. B. Kopenheimer Fund. The Department is in part supported by the Michael Reese Research Foundation.

TABLE I.—CONTROL SERIES

Dog No.	Duct ligation	Secretin injection L.	Arterial occlusion (5 minutes)	Edema	Postoperative day sacrificed	Gross findings	Histologic findings
	+	+		++	3		
	+	+		+++	6		
3	+	+		++	3	Pancreas somewhat indurated	
4	+		+		6		Beginning atrophy of pancreas
5	+		+		3	Pancreas indurated	
6		+	+		3		
7	+	+	+		8		

Edema: +moderate ++marked, +++very marked

aticedema, but without occlusion of the artery

Secretin was injected intravenously at a slow rate in two doses of 30 milligrams each given at a 5 minute interval. The ligation of the pancreatic duct was done with care so as not to traumatize the pancreas. We found that the main pancreatic artery could be exposed and clamped easily where it branches from the hepatic artery and runs straight caudad in the gastrohepatic ligament. The artery was occluded with a soft rubber-covered bulldog clamp for 15 minutes and after removing the clamp we ascertained by palpation and inspection that circulation in the distal portion of the artery was normal again. The animals, with the exception of 3 that died after the operation were sacrificed between the 2nd and 8th postoperative days.

The results are presented in Table I which contains the control experiments and in Table II which shows the results in the 10 dogs in which temporary occlusion of the pancreatic artery was performed in the presence of edema of the pancreas.

Dogs 1, 2 and 3 (Table I) developed an extensive edema of the pancreas following ligation of the main pancreatic duct and subsequent injection of secretin. No arterial occlusion was performed. The animals were sacrificed on the 3rd, 5th and 6th postoperative days, respectively and autopsy showed some induration of the pancreas in 1 of the dogs, but otherwise no gross and no microscopic changes of the pancreas. In dogs 4 and 5 the main pancreatic duct was ligated but no secretin was given and no edema appeared.

Subsequently the pancreatic artery was clamped for 15 minutes. These dogs were sacrificed on the 3rd and 6th postoperative days respectively. One of these dogs showed grossly an indurated pancreas, the other showed only microscopic signs of a beginning cirrhosis of the pancreas. Dog 6 received secretin injection without previous duct ligation and no edema developed. Five minutes after the termination of the secretin injection the pancreatic artery was clamped. The dog was sacrificed on the 5th postoperative day; autopsy revealed no gross abdominal pathology and no microscopic changes in the pancreas. Dog 7 received secretin after ligation of the main pancreatic duct but no edema developed. Five minutes after the termination of the secretin injection the pancreatic artery was clamped for 15 minutes. The dog was killed 8 days later. Autopsy revealed no gross abdominal pathology and no gross changes in the pancreas. Microscopic examination of several sections of the pancreas revealed a normal gland.

In Table II the results are tabulated according to the degree of pancreatic edema present just before occlusion. In experiments 8 and 9, without ligation of pancreatic ducts, a low grade edema appeared after secretin injection. Dogs 10 to 16 had the ducts ligated and developed pancreatic edema after injection of secretin. In 4 of these dogs only a moderate degree of edema appeared because relatively small doses of secretin had been administered to 2 dogs and a preparation of secretin of low potency had been given to the other 2 dogs.

TABLE II.—EXPERIMENTAL SERIES

Dog No.	Duct ligation	Secretin injection ↓	Arterial occlusion ( 5 minutes)	Edema*	Postoperative day		Gross findings	Histologic findings
					Sacrificed	Died		
8		+	+	(+)			Some bloody fluid in abdomen. Some fat necroses in pancreas and omentum	Fat necrosis of fat tissue. Superficial pancreatic necrosis
9	o	+	+	(+)			Many fat necroses in omentum. Bilateral pneumonitis	Fat necrosis of fat tissue
	+	+++	+	+	1		Some bloody fluid. Some fat necroses in and around pancreas	Fat necrosis of fat tissue
	+	+++	+	+		4	Some bloody fluid. Some fat necroses around pancreas. Bilateral pneumonitis	Edema of the pancreas. Superficial pancreatic necrosis
11	+	+	+	+	6		Some fat necroses in omentum	Fat necrosis of fat tissue
13	+	+	+	+	6		Some fat necroses in omentum	Fat necrosis of fat tissue
14	+	+	+	+++	3		Scattered fat necroses in omentum and mesentery. Middle portion of pancreas discolored, showing fat necroses	Hemorrhagic pancreatitis. Fat necrosis of fat tissue
15	+	+	+	+++			Acute pancreatitis with diffuse peritonitis	Pancreatic necrosis. Fat necrosis of fat tissue
16	+	+	+	+++			Large amount of bloody fluid. Large number of fat necroses in omentum and around pancreas. Edema of pancreas	Fat necrosis in pancreas. Edema of pancreas
17	+		+	+++	3		Large amount of bloody fluid. Diffuse fat necrosis. Acute hemorrhagic pancreatic necrosis	Pancreatic necrosis. Fat necrosis of fat tissue

\*Edema (+) slight; + moderate; ++ marked; +++ very marked

+Single dose of 25 mgm. secretin.

The 3 remaining dogs showed very extensive edema. Dog 17 developed very marked edema of the pancreas shortly after ligation of the main and accessory pancreatic ducts and therefore temporary arterial block was performed without injection of secretin. Dogs 9 and 11 died of pneumonitis on the 2nd and 4th postoperative days respectively, and dog 15 died of pancreatitis and peritonitis on the 2nd postoperative day.

Table II shows, in contrast to Table I, that in every dog some degree of pancreatitis and of fat necrosis existed. The 6 dogs (8 to 13) that had only low grade edema of the pancreas at the time of the arterial occlusion did not show marked generalized changes of the pancreas but 4 of these dogs had bloody intra peritoneal fluid and all of these animals had fat necroses around the pancreas and in the omentum. Microscopic examination revealed fat necroses in all of these animals and small areas of glandular necrosis in the pancreas of dogs 8 and 11.

All dogs with extensive pancreatic edema at the time of arterial occlusion revealed pronounced changes. Dog 16 had large numbers of fat necroses in the omentum and around the pancreas and sections revealed extensive areas of fat necrosis in the pancreas and in the peripancreatic fat tissue. The 3 other dogs showed changes that looked like pancreatic necrosis or hemorrhagic pancreatitis with diffuse fat necrosis which on microscopic examination proved to be hemorrhagic and necrotizing pancreatitis with extensive fat necrosis.

## COMMENT

Since we did not succeed in producing pancreatic necrosis by increasing or prolonging the edema producing administration of secretin it became apparent that pancreatic necrosis or hemorrhagic pancreatitis is not merely an advanced form or a later stage of pancreatic edema. It seemed probable that an additional factor was responsible. This additional factor was not added by such procedures as obstruc-



tion of lymphatic drainage obstruction of venous return from an edematous pancreas or the production of shock in dogs with edema of the pancreas. However positive results were obtained with the temporary occlusion of the main pancreatic artery if performed while edema of the pancreas was present. If no edema of the pancreas was present clamping of the pancreatic artery did not produce pancreatitis. When pancreatic edema was present, clamping of the artery caused pathologic changes in and around the pancreas that were in direct proportion to the degree of the edema, whether the edema was caused by injection of secretin or had developed spontaneously. In case of low grade edema only fat necroses developed but in cases with extensive edema all the changes were found that severe forms of pancreatitis can reveal.

We have shown in previous experiments (4) that edema of the pancreas can be produced by vigorous stimulation of the external pancreatic secretion by secretin injection after the main pancreatic duct has been ligated and we have shown (2) that the intrapancreatic and peripancreatic edema consists of pancreatic juice that has diffused into the connective tissue of the gland. The edema will do little or no damage to the pancreatic gland and will disappear shortly after the secretory stimulus has been discontinued, leaving few or no traces. This process seems to be identical with the clinical picture of transient pancreatitis.

However when the arterial supply of the pancreas is interrupted in the presence of pancreatic edema changes will develop that range from mild forms of intrapancreatic fat necrosis to severe hemorrhagic and necrotizing pancreatitis. The temporary ischemia probably lowers the resistance of the cells to the enzymatic action of the edema fluid but it is possible that the pancreatic enzymes of the edema fluid might be activated by contact with unpaired cells.

Whatever the explanation may be the important fact is that temporary local ischemia is able to transform a clinically harmless transient edema of the pancreas into a hemorrhagic pancreatic necrosis.

The clinical applications of these experimental observations are

1 Local vasomotor changes may be responsible for the transition of pancreatic edema into pancreatic necrosis.

2 The extent of local vasomotor changes may determine the degree of pancreatitis.

3. If acute pancreatitis is diagnosed or its presence is suspected everything should be done to make a presumably present edema disappear and to avoid local ischemia.

To make the edema disappear it seems best to give spasmolytics which will relax the sphincter of Oddi to prevent any stimulation of the external secretion of the pancreas, and to attempt its active inhibition. There is little we can do to prevent local ischemia except to prevent shock and to avoid medication that has a vasoconstrictor effect in the splanchnic area. Administration of papaverine with its vasodilating action may be of value.

Local vasomotor changes are nothing unusual after surgical procedures and this may in part explain the poor results of surgical intervention in acute pancreatitis.

In previous publications (1) impressive therapeutic results were reported with para-vertebral block in acute pancreatitis. In the light of the recent experiments it seems suggestive to ascribe these good results partly to local vasodilation produced by blocking the sympathetic innervation to the pancreas.

#### SUMMARY

Experiments prove that pancreatic edema and acute pancreatitis or pancreatic necrosis are not merely different degrees of the same process but that another pathogenetic factor is necessary to transform one into the other.

In animal experiments transformation of pancreatic edema into pancreatitis or pancreatic necrosis was attained by temporary occlusion of the main pancreatic artery.

The important part which local vasospasm and ischemia may play in the development of clinical cases of acute pancreatitis is discussed and therapeutic measures are recommended.

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# SELF CENTERING LORENZ OSTEOTOMY

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**T**HE Lorenz osteotomy has proved one of the most effective methods of treating nonunion of fractures of the neck of the femur especially in the case of elderly people who could not tolerate some of the more extensive operative interventions

Careful analysis of a relatively large number of such operations, performed during the last 9 years, has shown that the most common cause of failure has been the displacement of the shaft of the femur either anteriorly or posteriorly to the stump of the neck and head against which the shaft must impinge for stability on weight bearing. The "self centering" Lorenz osteotomy has been devised to minimize this danger.

The principle of the self centering osteotomy is the "V" cutting of the femur at just above the superior border of the lesser tro-

chanter so that a trough is made from the lateral to the medial aspect of the femur with the central portion of the "V" about  $\frac{1}{2}$  inch lower than the sides. The "V" cut then tends to center the shaft of the femur under the head, and there is far less tendency for it to gravitate either anteriorly or posteriorly to the desired position. As is already well known to those who have done the Lorenz osteotomy the shaft must be pushed medially so that it comes to rest directly under the head.

The direct lateral approach has the advantage of less surgical trauma and of speed of procedure. When excellent x ray facilities are available for control, this approach is the preferred method especially in thin people. When x ray facilities are not available, and in obese women it has been the author's experience that the 'hockey stick' incision with cutting of the fascia lata at the inferior portion of the

From the Fracture Service, Cook County Hospital.

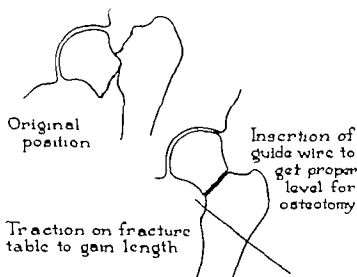


Fig 1

Fig 1 It is desired that the osteotomy be done just above the superior margin of the lesser trochanter. For this reason a Kirschner wire should be placed, under x-ray control, at the desired angle and location for the osteotomy.

Fig 2 In the original Lorenz osteotomy a transverse cut was made as illustrated in Figure A, with a resulting possibility of the shaft gravitating either forward or backward from the desired central position as illustrated in Figure B.

Fig 3. By producing a forked osteotomy Figure A, the shaft tends to seek and maintain a central position

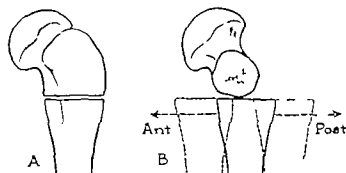


Fig 2

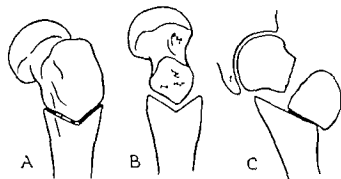


Fig 3

under the head and neck, Figure B because of the slanting sides of the osteotomy which constantly tend to "self center" the shaft of the femur. The anteroposterior position of the resulting osteotomy should be as shown in Figure C.

incision and muscle plane dissection between the rectus femoris and extensor fascia femoris, has been more advantageous. By opening the capsule through a longitudinal incision direct visual control is possible of the fracture site, the location of the osteotomy and the final position of the shaft of the femur under the neck of the femur.

In doing the osteotomy a longitudinal muscle splitting of the vastus lateralis can be carried out and the lateral aspect of the femur exposed. In the author's experience this procedure has been most advantageous, as it can be rapidly done and the occasional bleeder can be readily isolated and ligated. Others prefer to locate the posterior margin of the vastus lateralis and reflect the entire muscle anteriorly thereby exposing the femur at the desired level for the osteotomy. Either method is satisfactory.

Postoperatively the patient must be placed with the limb operated upon in wide abduction

to maintain the shaft of the femur under the head. A spica cast to the toes on the side operated upon and to the knee on the other side is the best method of immobilization. In the application of the cast, care must be taken that too much strain is not placed on the medial side of the knee joint when abduction of the femur is sought, otherwise an undesirable genu valgus results.

It has been found most advantageous to maintain immobilization in a cast for 8 weeks and then to place the limb in skin traction with five pounds of weight, and each day bring the leg a little more into adduction. When the extremity reaches a parallel position to the long axis of the body the traction is removed and the patient is gotten up on crutches with light weightbearing.

In the average case ambulation with a cane and with minimal discomfort is possible in about 4 to 6 months after operation has been carried out.

# FACTORS INFLUENCING MORTALITY FROM ACUTE PERFORATED PEPTIC ULCERS

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**A**LTHOUGH considerable strides have been made in the treatment of perforated peptic ulcer since the first successful closure reported in 1892 by Heussner, this condition remains one of the most serious of the common emergencies of abdominal surgery. Recent reports indicate a marked reduction in operative mortality rates from the series reported in 1940 by DeBakey with 18.2 per cent mortality, to the more recent figures of Graham, 6.4 per cent; Fallis, 8.3 per cent, and Bantell, 1.1 per cent.

Our mortality statistics are not presented as representing the ultimate goal of therapy. Most of our group of patients are from the lower strata of society and enter the hospital in poor nutritional and physical condition. This type of patient taxes therapeutic measures to the utmost.

The present study comprises 336 cases of acute perforated peptic ulcer seen at the Cincinnati General Hospital during the 12 year period 1935-1946 inclusive, and treated by the resident surgical staff (Fig. 1). In routine care at this clinic simple closure of the ulcer, closure of the abdomen with wire, and careful pre-operative and postoperative control of fluid balance have been emphasized. The general mortality by 3 year periods has shown a progressive decline from 31 per cent in the period 1935-1937 to 11 per cent for the period 1944-1946. The operative mortality has been reduced from 21 per cent to 10.7 per cent in the same time (Fig. 2).

One of the most important factors affecting the operative mortality in perforated ulcer is the time elapsing before closure of the perforation (Table I). Comparison of our series with that of DeBakey shows that 87.9 per cent of

our patients were operated upon within the first 12 hours as compared with 81.85 of his cases. DeBakey reported that the mortality rate increased from 14.6 per cent in patients operated upon within the first 12 hours to 42.6 per cent of those in the 12 to 24 hour group and reached 61.5 per cent in patients in whom over 24 hours had elapsed. Our mortality statistics for the period 1935 to 1941 are substantially the same as DeBakey's, but in the last 3 year period (1944-1946) we have experienced a drop to 6.4 per cent mortality among patients undergoing operation within the first 12 hours.

The age of the patient also markedly influences the mortality rate (Fig. 3). More than three times as many deaths occur in the 50 to 59 year age as in the 20 to 29 year old group. Comparison of our series with that of DeBakey shows a striking similarity in the mortality curve, deviating only at the 70 to 79 year group. Tabulation reveals that 41.5 per cent or less than half of our patients have been under 40 years of age, as compared with 55.1 per cent of DeBakey's series (Fig. 4). We have further noted in comparing our patients of the 20 to 29 year age group with the patients over 50 that 22.5 per cent of the older group were seen more than 24 hours after perforation while in the younger group only 4.5 per cent entered the hospital after 24 hours had elapsed. In our cases the diagnosis has been more often missed or delayed in the older patients since many of this group enter the hospital late in the course of their illness.

Three adjuvants to routine treatment have been added in the 12 year period covered by this study. These have been (1) the use of continuous gastric suction, (2) the use of spinal anesthesia, and (3) the introduction of chemotherapy (Fig. 5). Wangensteen suction drainage was introduced in 1935, and since 1938 has been used in 100 per cent of the cases. Spinal

From the Department of Surgery, College of Medicine of the University of Cincinnati, and the Cincinnati General Hospital. Presented in the Forum on Fundamental Surgical Problems before the Clinical Congress of the American College of Surgeons, September 8-12, 1947.

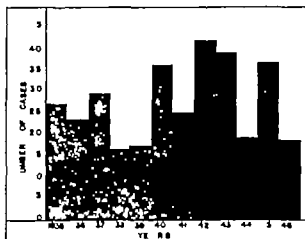


Fig. 1. Number of cases seen per year in period 1935-1946, of total of 336 cases at Cincinnati General Hospital.

anesthesia was also introduced in 1935 and has been employed in varying numbers of cases throughout the 12 year period. We have not been able to demonstrate that the use of spinal anesthesia directly affects the mortality rate nor that respiratory complications have increased or lessened because of its use.

Administration of sulfonamides was begun in 1938 and was gradually increased until 100 per cent of patients with perforated ulcer were receiving this therapy by 1945. In 1945 penicillin was given to 50 per cent of the cases; by 1946 all patients received penicillin and 50 per cent were given sulfadiazine in addition.

The value of chemotherapy in decreasing the incidence of wound infection and subphrenic abscess is clearly demonstrable. Wound infection which had occurred as frequently as in 30 per cent of the cases (Fig. 6) was reduced to 10 per cent when half of the patients oper-

TABLE 1—PERFORATED PEPTIC ULCER—306 PATIENTS OPERATED UPON AT CINCINNATI GENERAL HOSPITAL, 1935-1946

Hours elapsed before closure: comparison with DeBakey

Hours	Number of cases	Per cent	DeBakey
1 to 6	14	46.44	90.85
6 to 12	26	8.5	2
12 to 24	5	9	0.1
24 to 48	8	26	4.3
Over 48		28	13.64
Total cases	306		

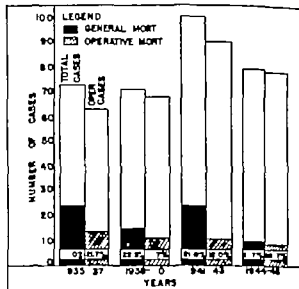


Fig. 2. Comparison of general and operative mortality rates by 3 year periods, 336 cases seen at Cincinnati General Hospital from 1935 through 1946.

ated upon received penicillin and was completely eliminated with routine administration of penicillin. The most striking results have been obtained in the group of patients undergoing operation within the first 6 hours after perforation and given chemotherapy. There have been no deaths in this group in the last 3 year period. In the group operated upon within 7 to 12 hours after perforation and given chemotherapy mortality has been reduced from 21.6 per cent to 10 per cent since the use of sulfonamides, and to 7.7 per cent with the introduction of penicillin. Subphrenic abscess has occurred in 11 patients following closure of gastroduodenal perforation. Eight of these developed subphrenic abscess despite the fact that they were receiving sulfonamide therapy. Since the use of penicillin there has been no incidence of subphrenic abscess. Analysis of the 73 deaths (Fig. 7) revealed that generalized peritonitis was the cause of death in 46.6 per cent. Shock and respiratory complications each caused 13.3 per cent of the deaths and cardiac difficulty was responsible in 10.6 per cent. Since peritonitis was determined to be the cause of death over 3 times as often as any other single cause, we believe that the bacterial element in perforated ulcer is a most important factor.

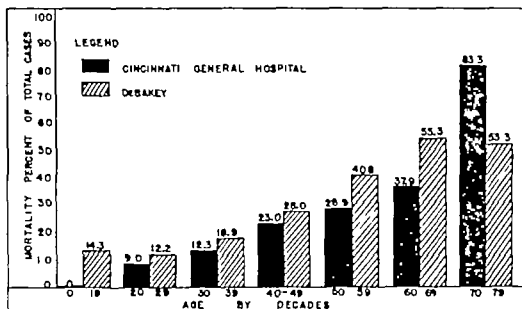


Fig 3 Mortality rate according to age comparison with DeBakey

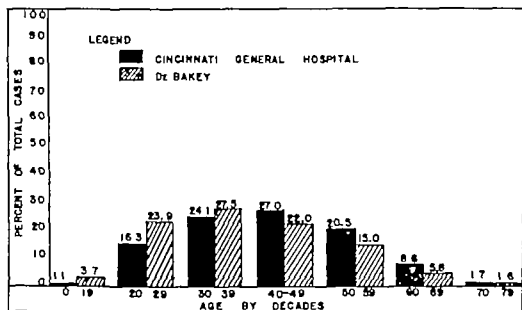


Fig 4 Age incidence compared with series reported by DeBakey

Eighty-seven per cent of the patients seen gave a history of previous epigastric distress. Seventy per cent of those with epigastric symptoms gave a history of over 6 months duration. In our study there were 10 perforations, an incidence of 2.9 per cent. Nine of these were seen in the first 6 hours. One re-perforation was fatal.

Thirteen cases were not recognized as perforated ulcer on admission of patient to the hospital and diagnosis was made on the medical or the psychiatric services. Twelve of these had had ulcer perforated for longer than 24 hours. In 45 per cent of the cases positive

diagnosis could not be made. One of the causes for delaying diagnosis was gradual onset of symptoms. Five per cent of our patients had a gradual onset of abdominal pain. In an additional 5 per cent, abdominal pain was noted to occur most markedly in the right lower quadrant.

Vomiting occurred in 47 per cent of the series following perforation, 24 per cent experienced vomiting one time and 23 per cent vomited more than once. It has often been said that patients with perforated ulcers do not vomit. This has not been true of almost one half of our cases. It seems likely that the

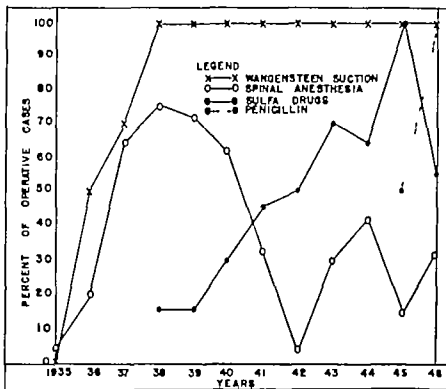


Fig. 5. Percentage of cases receiving Wangensteen suction drainage, spinal anesthesia, sulfonamide drugs, and penicillin.

amount of material in the stomach at the time of perforation determines the amount of vomiting.

Graham found that the white count is usually elevated and in his series there was only one instance in which the white count was below 5,000. In 4 per cent of our series the white count was below 4,000; in 27 per cent it was between 5,000 and 10,000; in 33 per cent between 10,000 and 15,000; and in 35 per cent above 15,000. Sixty per cent of our cases had a white count of more than 10,000. Temperature on admission to the hospital was less than 99 in 53 per cent of the cases; in 25 per cent it was between 99 and 100; and in 22 per cent it was over 100.

Free air in the peritoneal cavity was demonstrated roentgenologically in 66 per cent of the cases. Abdominal findings were described as board-like or markedly spastic in 68 per cent of the cases. Nineteen per cent had increased abdominal spasm, and distention was not uncommonly seen in cases in which perforation had been present over 24 hours. Hypoactive

peristalsis was recorded in only 12 per cent of the cases.

The location of perforation was near the outlet of the stomach in 84.7 per cent of the cases (duodenal 56.8 per cent and pyloric 27.9 per cent). Five and three-tenths per cent were gastric and an additional 1.4 per cent occurred on the posterior surface of the stomach. In the remaining 8.6 per cent the location was not reported. The most frequent location of perforation, i.e. near the pylorus, had apparently not been realized by all of the operators, judging by the length of some incisions. Shorter incisions in certain instances might have reduced the incidence of wound infection and evisceration.

Simple closure of the ulcer consisted of laying three or four Lambert sutures of silk through the ulcer bed, closing the ulcer and placing a tag of omentum in the long ends of the sutures and tying it down over the suture line. In cases in which the ulcer could not be easily closed a fold of stomach has been drawn down over the perforation. No cases of py

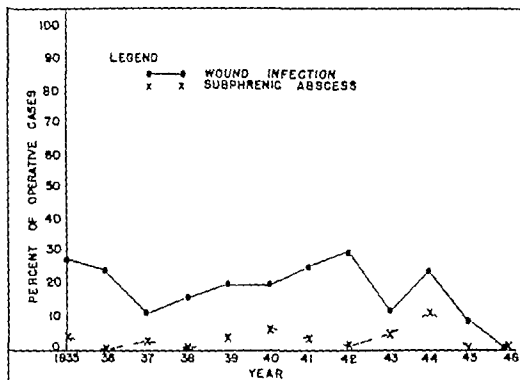


Fig. 6. Incidence of subphrenic abscess and wound infection.

long stenosis were noted. Two cases of duodenal fistula, one of which communicated with a subphrenic abscess were encountered.

Wound closure was carried out by through and through silver wire plus catgut in the peritoneum and fascia in 60 per cent of the cases. Thirty per cent were closed with through and through silver or steel wire with no peritoneal closure. Four per cent were closed in layers with catgut with silkworm gut stays and 4 per cent were closed in layers with silk.

Wound eversion has been the chief incentive for wire closure. In 8 instances eversion requiring secondary closure occurred. Silver wire had been used in 5 of these. Three eversions were associated with coughing and in each instance the wires broke. The cause was attributed to finer grades of silver wire being used at that time than is ordinarily recommended and steel wires have been more extensively adopted since. Eversion occurred in one individual in whom the peritoneum had been closed in addition to the silver wires. In the other case omentum herniated between the wires. In 2 cases in which closure had been made with catgut and silkworm gut stays the sutures broke. In the eighth case closure had been made in layers with silk. Three patients died after eversion.

In the last 6 years positive cultures were obtained at operation in 29.8 per cent of the cases. In one-fourth of this group the outcome was fatal. On the other hand seven-eighths of all fatal cases for this period had had positive cultures at operation. Other writers have reported an incidence of positive cultures at operation varying between 0 and 93 per cent. Brilt reported 74 per cent positive cultures in cases undergoing operation within 6 to 12 hours, and 93 per cent in cases in the group over 12 hours. The fact that an average of 23 per cent of cases in this series developed wound infection prior to the use of penicillin although positive peritoneal cultures were obtained in only 29.8 per cent of the cases indicates that the organisms are of a very virulent nature or that our present culture methods are not adequate. Analysis of culture reports reveals that 49 per cent of the positive cultures contained more than one organism. *Streptococcus* was found in 75.47 per cent of the cultures, 23 per cent of these were of the hemolytic type. *Staphylococcus* was found in 32 per cent. *Bacillus coli* in 18.8 per cent, and *Aerobacter aerogenes* in 15 per cent.

Shock associated with acute perforated ulcers has been a subject of considerable discussion. Soutter studying 335 cases found pro-



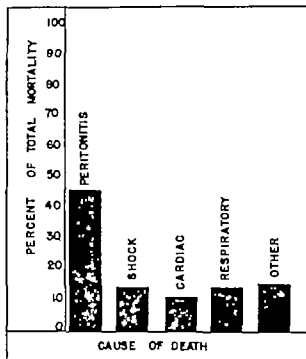


Fig. 7 Cause of death—73 cases.

found shock in only 3 instances and mild shock in 6 per cent. He attributed early shock to associated hemorrhage and late shock to peritonitis. Graham emphasized the nutritional and biochemical imbalance associated with shock as being responsible for the serious state of these patients. Blood pressure has been selected as the most constant single criterion of shock. In this series there were 25 patients or 7.4 per cent with blood pressure below 100 millimeters systolic on admission. In 14 or over half of these the ulcer had been perforated less than 12 hours. Three of the patients with perforation of less than 12 hours duration succumbed to shock and were not operated upon. One of these patients was a female, age 52 with a previously perforated gastric ulcer who was in shock on admission 4 hours after perforation. She had associated gastric hemorrhage and expired. The 2 other cases were 7 and 12 hours post perforation respectively. There was no evidence of gastrointestinal hemorrhage but in spite of therapy with intravenous blood both expired.

Ten of the patients in shock on admission less than 12 hours after perforation were operated upon with 8 recoveries. None of the 11

patients entering more than 12 hours after perforation with blood pressures under 100 millimeters systolic survived. Five of these underwent operation.

Four cases with adequate blood pressure at time of operation died within 36 hours after operation in shock like condition. They had been closed  $2\frac{1}{2}$ ,  $7\frac{1}{2}$ , 9 and 17 hours respectively following perforation. Three of these had positive cultures in the peritoneal fluid. In another instance a patient who had an ulcer perforated for  $5\frac{1}{2}$  hours was given a spinal anesthetic, following which the blood pressure fell and he succumbed.

There have been 38 patients who had perforations for over 24 hours before admission to the hospital. Fourteen of these who had adequate blood pressures were operated upon. Four survived giving a mortality of 71 per cent. Twenty four patients were treated without operation 16 of whom died a nonoperative mortality of 66 per cent. In our hands nothing has been gained by operation after 24 hours postperforation.

Thirteen of the patients in this study have been women an incidence of 3.8 per cent, as compared with 19 per cent in DeBakey's Charity Hospital series and 7.7 in his collected series. Of the 13 11 were over 40 years of age. Only 6 of the women were admitted in the first 12 hours postperforation. There were 5 deaths, 4 of which followed perforation for over 24 hours. The occurrence of perforation in women near or after the menopause is in keeping with the work of Sandweiss who believes that there is a protective mechanism produced by the ovary and the pituitary gland in younger women which lessens the chance of perforation occurring.

Our therapy although not striking in comparison with the work of others has shown a steady improvement in survival rate in the 13 year period 1935 to 1946. Analysis of the operative deaths for the last 3 years shows that over half of our patients have entered the hospital more than 6 hours after perforation had occurred. In order to give a clearer picture of the type of patient seen at the Cincinnati General Hospital an important influencing factor on our mortality statistics the 9 fatal cases of the last 3 years are briefly summarized.

**CASE 7.** White female, aged 67 years. This patient was admitted 9 hours after perforation and air was demonstrated under the diaphragm on roentgenological examination. She was treated with 3 units of blood and 2 of plasma. A large perforation of the greater curvature of the stomach was closed under cyclopropane anesthesia 16 hours after perforation. *Streptococcus nonhemolyticus* and *Staphylococcus hemolyticus* were cultured from the peritoneal cavity. Despite administration of 20,000 units of penicillin every 3 hours the patient died within 48 hours. Necropsy revealed (1) acute fibrinous peritonitis and (2) acute lobular pneumonia.

**CASE 2.** White female aged 76 years. This patient entered the hospital 48 hours after onset of symptoms, and received intravenous fluid therapy for 2½ hours. A small perforation of the anterior duodenum was closed under cyclopropane anesthesia and a peritoneal culture was taken which revealed a yeast. The patient died on the 18th postoperative day. Necropsy showed (1) peritonitis and (2) thrombosis of mesenteric vessels with small and large bowel infarction.

**CASE 3.** Colored male aged 36 years. This patient had far advanced tuberculosis. A large perforation of the lesser curvature of the stomach was closed 12 hours after its occurrence. Although the patient received penicillin and sulfadiazine his postoperative course was very stormy and he died on the 14th hospital day. Autopsy revealed a perforated duodenal ulcer below the one which had been closed.

**CASE 4.** Colored male aged 45 years. A large perforation of the pylorus of at least 48 hours' duration on admission was closed under local anesthesia despite the low blood pressure of the patient. A *Streptococcus* and *Bacillus coli* were revealed in cultures obtained at operation. Despite supportive therapy including 15,000 units of penicillin every 3 hours 3 units of blood and oxygen by catheter the patient remained confused and disoriented and died within 36 hours.

**CASE 5.** White male aged 50 years. A small perforation of the anterior duodenum was closed 9½ hours after occurrence under cyclopropane anesthesia. A *Streptococcus* was cultured from the peritoneal cavity. He was given sulfadiazine 5 grams daily until the third day when he received in addition penicillin 20,000 units every 3 hours. He developed delirium tremens on the 4th hospital day, and died on the 5th hospital day of bronchopneumonia.

**CASE 6.** White male alcoholic, aged 55 years. This patient was admitted to the hospital with a fractured femur. He developed a large anterior duodenal perforation which was closed 17 hours after occurrence. A *Bacillus aerogenes* was cultured from the peritoneum. In spite of two units of blood and two units of plasma this patient went into shock and did not recover.

**CASE 7.** White female, aged 58 years. This patient entered the hospital 12 hours after onset of symptoms and was given one unit of blood on admission. A large perforation of the pylorus was closed under

local anesthesia 6½ hours later. *Staphylococcus aureus* hemolyticus, *Streptococcus viridans*, and *Streptococcus nonhemolyticus* were cultured from the peritoneum. She received 5 grams of sulfadiazine daily but died on her fourth hospital day. Autopsy revealed generalized peritonitis.

**CASE 8.** Colored male aged 58 years. This patient entered the hospital 32 hours post perforation. After 4½ hours of therapy including blood transfusion a small anterior duodenal perforation was closed under cyclopropane anesthesia. *Streptococcus viridans* was cultured from the peritoneum. The patient received sulfadiazine 5 grams daily for the first 7 days, and penicillin 20,000 units every 3 hours was added thereafter. He died on his 11th postoperative day. Necropsy revealed generalized peritonitis, subhepatic abscess and pulmonary infarct.

**CASE 9.** White male aged 33 years. A small perforation of the anterior duodenum was closed under cyclopropane anesthesia 7 hours after duodenal rupture. The patient developed delirium tremens on his second postoperative day. He received 5 grams of sulfadiazine daily for 10 days. He insisted on leaving the hospital on the 24th hospital day while still running a febrile course but soon returned and succumbed on his 62nd postoperative day. Autopsy revealed multiple gastric ulcers, multiple liver abscesses, subhepatic abscess, peritonitis, and portal thrombosis.

#### SUMMARY

A report of 336 cases of acute gastroduodenal perforation in a large general hospital has been made. The mortality rate has shown a progressive decline from 21 per cent to 10.7 per cent in the 12 year period 1935 to 1946. Under combined penicillin and sulfadiazine therapy the mortality rate has been dropped to 0 per cent in patients treated in the first 6 hours and to 7.5 per cent in patients treated between 6 and 12 hours.

Introduction of chemotherapy with both penicillin and sulfadiazine at the time of diagnosis is advocated since bacterial infection is a most important factor in mortality. Eighty-eight per cent of fatal cases had a positive culture from the peritoneal cavity. There was 25 per cent mortality among patients from whom a positive culture was obtained at operation. Seventy-five per cent of the positive peritoneal cultures contained a *Streptococcus*. Generalized peritonitis was the greatest single cause of death.

Efforts should be directed at early diagnosis especially in women and in older people. In such patients symptoms are not so dramatic

and apparent as in the younger group. Although death from postoperative shock has been rare in our series, it continues to be a factor and all patients should receive adequate preoperative fluids and antishock therapy.

Perforated gastroduodenal ulcers of over 24 hours' duration have done poorly in our hands with or without operation.

#### CONCLUSIONS

Early diagnosis and prompt surgical intervention with supportive chemotherapy are the

most important factors involved in the successful treatment of acute perforated gastroduodenal ulcer.

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# INTRAVENOUS, SUBCUTANEOUS AND RAPID INTRAMUSCULAR INFUSIONS OF "PROTEIN HYDROLYSATE"

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**A**RATHER exhaustive investigation of parenteral bovine protein hydrolysate is being conducted. Since the maintenance of protein nutrition in surgical patients requiring parenteral feeding demands intensive therapy with large daily injections, we have attempted to analyze the effectiveness of intravenous, subcutaneous, and rapid intramuscular infusions of this protein hydrolysate. The study represents clinical as well as experimental experiences with parenteral infusions, further, the advantages and difficulties of the routes are discussed.

The major objectives of this study were (1) to determine with intravenous infusions the reaction incidence, the types of reactions, the average amount injected, the average rate of injection, the toxicities, and the local difficulties such as thrombosis, phlebitis, etc., (2) to determine the effect on the blood and urine of infusions of 1000 cubic centimeters of protein hydrolysate in 1 hour (3) to determine the plausibility of repeated subcutaneous infusions of 1000 cubic centimeters of protein hydrolysate in the thighs the effect on the blood on the legs, and the rate of absorption as determined with the use of phenolsulfonphthalein excretion as an indicator, (4) to determine the feasibility of rapid intramuscular injections of 1000 cubic centimeters of protein hydrolysate into the vastus lateralis of the thighs the effect on the blood, on the legs, the reaction of the tissues and the absorption rate as calculated by the use of phenolsulfonphthalein excretion as an indicator.

These studies were all conducted on preoperative and postoperative surgical patients on the wards at the Gallinger Municipal Hospital, Washington, D C. The variables were controlled as well as was possible with the

physical establishment available. All of the infusions and chemical analyses were performed by the author and a technician (George F. Lane).

## PREPARATION USED

The solution used in the study is 5 per cent parenteral protein hydrolysate in distilled water. The source of protein is bovine blood and is collected under sanitary conditions, processed, and hydrolyzed by means of a pancreatic enzyme preparation. The hydrolysate is then treated to remove harmful and undesirable constituents and diluted to the desired concentration. Filled sealed bottles of the solution are sterilized by autoclaving and packaged in 500 or 1000 cubic centimeter containers. The finished product is a light amber colored solution containing

Total solids	5.0 grams per 100 c.c.
Total nitrogen	0.55 gram per 100 c.c.
Ammonia nitrogen	0.015 gram per 100 c.c.
Alpha-amino nitrogen	0.275 gram per 100 c.c.
(approximately 50% of the total nitrogen)	
Sodium chloride	0.30 gram per 100 c.c.
	(approximately)
pH	6.20-6.40

Chemical analyses of protein hydrolysate reveal the following amino acids and their percentages

Arginine	4.91	Lysine	6.10
Aspartic acid	4.56	Methionine	1.06
Cystine	1.15	Phenylalanine	3.30
Glutamic acid	10.34	Threonine	6.00
Histidine	1.93	Tryptophane	1.43
Leucine	7.25	Valine	6.15
Isoleucine	3.94		

Each manufactured lot of protein hydrolysate solution is subjected to control procedures to show that it is sterile, nonpyrogenic, free of vasomotor substances, free of unhydrolyzed protein, and that it may serve as an adequate source of parenteral nitrogen.

## METHODS

1. Twenty four hour urine specimens were collected in receptacles containing toluol to

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prevent fermentation and were not pooled, but analyzed immediately after collection. Fractional urines studied were kept in individual containers, chemically studied separately and the total 24 hour results were computed by the addition of the individual figures.

2 Co-operative preoperative or convalescent surgical patients were used for the tolerance studies. They had no recognizable metabolic diseases and were not afflicted with ravages of serious surgical procedures or medical diseases (nephritis, hepatic diseases, nutritional deficiencies, etc.)

3 All blood samples were drawn from the opposite arm used for intravenous infusions into test tubes containing the anticoagulant heparin. These were not stored for longer than 12 hours at 4 degrees to 6 degrees centigrade before chemical analysis.

4 The total nitrogen and nonprotein nitrogen of the urine were obtained by Kjeldahl digestion, distillation and titration with .015 normal hydrochloric acid (13). Urea estimations were performed by digestion and nesslerization of the filtrate (13). All 24 hour urines were analyzed for total creatinine as a check against faulty collection of specimens. The creatinine output is rather constant under normal circumstances at a level of 0.9 to 1.3 grams per 100 cubic centimeters (13). Amino acid levels of blood and urine were estimated in milligrams by the Folin colorimetric method (2).

5 Control studies with phenolsulfonphthalein were conducted on all patients on whom the rate of excretion of this drug was used as an estimate of protein hydrolysate absorption when given either by subcutaneous or intramuscular route. The control or normal test was executed thusly: Each patient drank 1000 cubic centimeters of water rather than the conventional 500 cubic centimeters so as to keep the fluid intake equal to the amount to be injected. After the fluid intake 1 cubic centimeter containing 0.6 gram of phenolsulfonphthalein was injected intramuscularly. Urine specimens were obtained at 1 hour and 10 minutes, 2 hours and 10 minutes and 3 hours and 10 minutes after the intramuscular injection and the percentage of dye excreted was calculated by colorimetric comparison with known standards (3).

6 The absorption test with protein hydrolysate to which 0.6 gram of phenolsulfonphthalein is added was performed in the following manner: The day after the control study the same patients were infused either subcutaneously in 3½ hours or intramuscularly in 30 minutes with 1000 cubic centimeters of protein hydrolysate containing 0.6 gram of phenolsulfonphthalein. Urine specimens were collected at designated intervals, the percentage of dye excreted was obtained by colorimetric comparison and these figures were then compared with the corresponding control values of excretion. The percentage excretion of normal for this particular patient implies the rate of removal of the dye with the protein hydrolysate from the tissues and its appearance in the urine thus giving an approximate estimate of the rate of absorption from tissues of the solution containing the phenolsulfonphthalein.

7 Biopsy of muscle (vastus lateralis) is described to reveal the reaction of this tissue to repeated infusions of protein hydrolysate solution.

#### INTRAVENOUS ADMINISTRATION

An overall reaction incidence of 0.72 per cent was found in two thousand and three (2003) intravenous infusions of 1000 cubic centimeters each in 320 preoperative and postoperative surgical patients.

The types of cases in which the solution was administered frequently represented the more ill surgical patients for it is this group which requires parenteral protein feeding. Some of the surgical diseases included in the group studied are listed for review: ruptured appendicitis with diffuse peritonitis, subtotal gastrectomy and anastomosis for duodenal ulcer or gastric carcinoma, chronic cholecystitis and cholecystectomy, multiple perforations of the intestine after gunshot or stab wounds of the abdomen, perforated peptic ulcers with closure, intestinal fistulas, carcinoma of rectum with combined abdominoperineal resection, essential hypertension and thoracolumbar sympathectomy and splanchicectomy and others.

The average amount injected intravenously by gravity at each infusion was 1000 cubic

centimeters, and the usual time required for this quantity was 1 or 1½ hours, thus a rate of 14 to 17 cubic centimeters per minute. Three thousand cubic centimeters per day were administered by continuous drip into the saphenous vein for 7 days to a patient with a small bowel fistula. Hence the largest single injection in the study is 21,000 cubic centimeters. There was no ascending thrombosis or phlebitis in this case. The largest quantity given to a single patient was 42,000 cubic centimeters in 14 days. Many other patients received large amounts for adequate protein therapy, for nitrogen balance in patients on parenteral feeding alone requires full and adequate dosage.

Fifteen reactions were found in the entire study. Three of these or 0.14 per cent were characterized by flushing, warmth, nausea, and forcible vomiting, and were labelled 'systemic reactions'. Ten, or 0.49 per cent, were typical "pyrogenic reactions" which manifested themselves as chills, pyrexia, and tachycardia. Two 'allergic reactions' were noted in the same patient, thus an incidence for this type of 0.16 per cent. Of particular interest are the systemic reactions. The first two of these were the first reactions experienced in the entire study and occurred with the first batch of material investigated clinically. The third systemic reaction was noted 6 years after the above mentioned and was in a patient who had had a colon resection. He was receiving 3000 cubic centimeters of protein hydrolysate daily as part of a nitrogen balance study. The reaction occurred on the third day of the study with an infusion of hydrolysate which was being injected at an approximate rate of 15 cubic centimeters per minute. All of the manifestations were abated within 15 minutes after discontinuance of the infusion, but recurred after the infusion of 100 cubic centimeters at the original rate. No subsequent reaction developed when the remainder of the solution (500 c.c.) was infused at 8 cubic centimeters per minute. A sample of the solution causing the reaction was found to be sterile and contained only 50 per cent alpha amino nitrogen. The same patient received 13,000 cubic centimeters of the protein hydrolysate from the same batch causing

the reaction and no untoward manifestations were recorded.

In lieu of the recent observations of Hoffman Kozoll, and Osgood, of Smyth Lasichak and Levey, and of our recent observations (11) with rapid intravenous infusions of protein hydrolysate a blood amino acid level determination at the time of vomiting in the aforementioned reaction may have yielded significant data.

Both allergic reactions developed in the same case. The symptoms were puffed eyelids, large superficial wheals, and shortness of breath after the receiving of 200 cubic centimeters at 15 cubic centimeters per minute on subsequent days. Past history of the patient elicited allergies to milk as a child, diarrhea or hives when she consumes chocolate, and the same type of allergic reaction to amigen 5 months previously after 4 days of infusions of this latter preparation. Skin tests in this patient with protein hydrolysate solution produced a large allergic wheal. If patients can become sensitized to enzymatic hydrolysates of casein or blood it might prove a point of prevention to question all patients who are to receive intravenous infusions of hydrolysates as to whether they have had any previous infusion of protein digests, and as to the development of any allergic reactions. Further skin testing before infusions on patients who have received hydrolysates would perhaps screen out sensitive individuals.

Since all of the intravenous infusions of protein hydrolysate reported in this entire study were given by the author or a technician, we both had an excellent opportunity to observe the local manifestations. No acute ascending thrombophlebitis or ascending thrombosis was found in any case receiving 1000 cubic centimeters of hydrolysate solution in 1 or 1½ hours, even though repeated infusions were given in either antecubital vein on subsequent days. Local thromboses were found in the veins at the site of repeated injections and infusions. It is the impression of this observer that thrombosis is no more frequent with hydrolysate solution than with similar infusions of 5 per cent dextrose solutions. Much of the local vein reaction can be diminished if the following procedures are

TABLE I.—AVERAGE BLOOD AMINO ACID LEVELS, DIFFERENCES, AND PERCENTAGE OF NORMAL CHANGE FOR TEN CASES RECEIVING 1000 C.C. OF PROTEIN HYDROLYSATE INTRAVENOUSLY IN ONE HOUR

	Amino acid	Difference	Normal change— above normal Per cent	Differences in per cent of normal change
Normal level mgms/100 c.	6.5			
3000 cc.— $\frac{1}{2}$ hour	7.9	+1.4	7	+21.7
3000 cc.—1 hour	9	+2.5	43	+66.5
After $\frac{1}{2}$ hour	8.6	+2	34.2	-7.7
After 1 hour	7.66	+1.16	23.2	-23
After $\frac{1}{2}$ hours	7.06	+0.56	12.2	-9
After 1 hour	6.77	+0.27	8	-4.6

conducted (1) select a smaller needle than the caliber of the vein to be used for infusions (2) execute the venipuncture by a sharp clean puncture through the anterior wall of the vein without damage to the opposite or posterior wall (3) insert the needle well into the lumen of the vein (4) avoid undue movement of the needle in the vein during infusion by adequate fixation of the needle, adaptor tubing and the extremity used and (5) avoid long continued infusions in the same vein with a single venipuncture. The hazards of prolonged intravenous infusions are related in the following experience. A patient had received four individual infusions of 1000 cubic centimeters each of protein hydrolysate in the right arm at an approximate rate of  $1\frac{1}{2}$  hours. Another 1000 cubic centimeters of hydrolysate was inadvertently given slowly over a 5 hour period in the left arm. That night the patient noticed severe pain and soreness in the upper left arm and at the site of the injection in the antecubital fossa. Examination the next morning revealed complete thrombosis of the medial superficial vein of the upper arm extending from the antecubital fossa to the axilla. The skin adjacent to the vein showed inflammation the entire vein was exquisitely tender to palpation and movement of the arm produced discomfort to the patient. Four days of compressing were required to alleviate the manifestations. Hence because the discomfort was too great, it was not feasible to use the left arm for further infusions during the patient's hospital stay. The life of available accessible veins in the arm of patients on

intravenous feeding may be prolonged by the plan of starting well down on the forearm for the first infusions and then gradually ascending to the antecubital fossa with the repeated injections.

Few patients who have received 3000 or 4000 cubic centimeters of protein hydrolysate daily as part of an investigation of nitrogen balance have caused us any difficulty with successful venipuncture after numerous intravenous infusions. In a study of parenteral hydrolysates in parenteral nutrition Koop and associates report thrombosis as a common occurrence with all preparations used for considerable periods. "The tendency to thrombosis was subject to marked variation between individual patients and in several patients the infusion of hydrolyzed protein had to be stopped for this reason. Venous thrombosis appeared to be the chief limiting factor in parenteral nutrition (7).

*Blood amino acid levels and urine chemical changes with intravenous injection of 1000 cc. protein hydrolysate in one hour.* Ten pre-operative or postoperative surgical patients who did not manifest any gross evidence of nutritional deficiency or serious surgical maladies were used for this study. The average serum protein was 6.8 grams per 100 cubic centimeter of serum for the 10 subjects before the infusions. The intravenous injection of 1000 cubic centimeters of hydrolysate was performed in the right arm in the antecubital fossa by gravity in 60 minutes thus an approximate rate of 17 cubic centimeters per minute. The blood samples were drawn from





42.2 per cent above normal or a 2.6 milligram rise from the base reading. These figures indicate a higher percentage rise for the first 500 cubic centimeters as compared to the second. The difference may be explained by the fact that blood amino acids are being removed throughout the period of injection and that the rate of metabolism may somewhat parallel the level of amino acids in the blood. During the first half hour after the end of the 1000 cubic centimeter infusion 7.7 per cent decrease in amino acids is noted and a 13 per cent removal occurs in the following 30 minutes. Therefore 20.7 per cent of the circulating amino acids are utilized in the first postinfusion hour. The following 1 hour period showed a 13.5 per cent decrease in amino acid level. Survey of the individual cases reveals a close correspondence to the average figures presented. Finally 2 hours is the usual time required for the removal of the major part (81 per cent) of maximum total circulating amino acids resulting from the injection of 1000 cubic centimeters of protein hydrolysate in 1 hour.

Amino acids were not detected in any of the urine samples analyzed. The total urinary nitrogen determinations revealed 24 hour outputs ranging between 9.6 grams and 12.3 grams of nitrogen with an average output of 10.56 grams of nitrogen per day. This figure is well within the range of the average output of convalescing ambulatory surgical patients on a regular hospital diet in our institution. The total creatinine values varied between 1.1 and 1.4 grams and averaged 1.16 grams per 24 hour urine sample—a figure that represents the usual total output for creatinine. This is used as a guide for the correct collection of all urine specimens during the 24 hour study period. The effect of the intravenous administration of 1000 cubic centimeters of protein hydrolysate in 1 hour on the blood amino acid nitrogen and the urinary excretion of nitrogen and amino acids is shown in Chart 1.

No nausea or vomiting was seen in any of the 10 cases with the infusion of 1000 cubic centimeters of protein hydrolysate in 1 hour or at a rate of 16 cubic centimeters to 17 cubic centimeters per minute. Recent observations to be reported show that vomiting occurs

with protein hydrolysate when it is given at a rapid rate varying between 50 cubic centimeters per minute and 140 cubic centimeters per minute. The blood amino acid levels at this point are 14 milligrams per 100 cubic centimeters of serum or more (11).

#### SUBCUTANEOUS ADMINISTRATION

Four hundred and twenty subcutaneous infusions of 1000 cubic centimeters of protein hydrolysate have been infused into 136 patients without any local difficulties or failure of absorption. Twenty five or 50 cubic centimeters of 1 per cent novocain is added to the solution partially to novocainize the area of injection. Slow even infusions without undue distention permit the most comfortable and readily absorbed subcutaneous infusions. It is a mistake to overdilate subcutaneous tissues by rapid infusions of protein hydrolysate. The practice of rapidly infusing 200 cubic centimeters or more, stopping the infusion until absorption has taken place and repeating this process four or five times until 1000 cubic centimeters is administered is faulty for it produces local discomfort, pain delays or prolongs absorption and increases the incidence of local complications.

In this study the site used for subcutaneous infusions was the anteromedial aspect of both thighs. A 2½ inch, No. 18 or 19 gauge needle is most commonly employed. When feasible, a novocain intradermal wheal is made before insertion of the needle into the subcutaneous tissue. The usual time required for the infusion of 1000 cubic centimeters of protein hydrolysate varies between 2½ and 4 hours. The time factor is influenced by the degree of hydration, the amount of subcutaneous fat, and the age of the patient. Elderly patients who are not too thin seem to absorb the fluid more readily than the average young or middle aged adult. A normal amount of subcutaneous fat aids absorption whereas excessive amounts of soft fat decrease absorption and enhance local complications. It is our common practice to refrain from using the subcutaneous route in patients with pendulous fat thighs. The patients receiving protein hydrolysate subcutaneously are those on parenteral feeding either before or after surgery. Another group

TABLE II.—BLOOD AMINO ACID LEVELS AFTER SUBCUTANEOUS INFUSION OF 500 C.C. OF PROTEIN HYDROLYSATE IN ONE AND ONE HALF HOURS

Case	1	2	3	4	5	6	7	8	9	10	Average values	Per cent of normal
Normal level 100 c.c./mgm.	6.1	6.3	6.8	6.4	6.6	5.5	5.8	6	6.0	6	6.17	
After 50 c.c.	6.6	6.6	6.9	6.6	6.7	5.8	6	6.6	6	6.6	6.47	4.9
After 500 c.c.	7	6.9	7.3	7.3	6.9	6.3	6.3	6.8	6.6	7	6.91	3
After 1/2 hour	7.4	7.0	7.3	7.3	7.3	6.6	6.3	7.3	6.7	7.4	7.06	15.5
After 1 hour	7.4	6.9	7.3	7	7.3	6.3	6.4	7.0	6.6	7.3	6.97	3
After 1 1/2 hours	7.0	6.8	7	6.6	7	6	6	6.8	6.3	7	6.7	1
After 2 hours	6.8	6.4	6.9	6.3	6.9	5.9	6	6.4	6	6.6	6.46	1.6

of patients who frequently are given this solution subcutaneously are infants or children but these are not included in this report. We usually give only 1000 cubic centimeters a day to adults by the subcutaneous route. However, on occasions it becomes necessary to administer larger amounts to those patients who have a limited number of accessible veins or to those with cardiac diseases in whom the possibility of cardiac overloading is imminent. The largest single amount administered subcutaneously was 23 000 cubic centimeters over a 14 day period. In one instance a patient was kept in positive nitrogen balance for 8 days with parenteral protein hydrolysate subcutaneously as the sole source of proteins. She received 2000 or 3000 cubic centimeters daily by this route without any severe local reactions. After the fourth day the thighs were tender and painful but we continued the therapy by the same route for 4 subsequent days.

*Blood amino acid levels and urine chemical changes with subcutaneous injection of 500 c.c. of protein hydrolysate in one and one half hours.* Ten uncomplicated postoperative inguinal hernia patients were selected for these tolerance studies. These patients had been operated upon either 6 or 7 days previously were on regular hospital diets, and ambulating. The 500 cubic centimeter infusion was administered into each thigh on the anteromedial aspect by gravity at a rate of 5 to 6 cubic centimeters per minute. At this speed there was no overdistention of the tissues or excessive bulging in the injected area. One per cent novocain was not used in these cases. Blood samples were drawn from either arm before

the injection after the infusion of 250 cubic centimeters after 500 cubic centimeters and 30 minutes 1 hour 1 1/2 and 2 hours following the completion of the infusion. A total 24 hour urine was collected fractionally the day of the infusion. Table II describes the changes in the blood amino acids.

The average amino acid level in these 10 patients was 6.17 milligrams per 100 cubic centimeters of serum and the individual findings varied between 5.5 milligrams and 6.8 milligrams per 100 cubic centimeters. After the infusion of 250 cubic centimeters a 4.9 per cent elevation was noted, or an average rise of 0.3 milligram per 100 cubic centimeters of serum. The injection of the next 250 cubic centimeters produces an 8.1 per cent rise from the previous figure or a 13 per cent increase above the original base level. There is a continued rise of the amino acids by 0.1 milligram in the 30 minute period following the completion of the injection. During the oncoming 30 minute period a slow decrease occurs in the blood amino acids. The findings in sequence are 0.1 milligram 1.5 per cent of normal 0.2 milligram 3.0 per cent of normal and 0.3 milligram 4.9 per cent of normal—a total decrease at this point (2 hours after completion of the infusion) of 0.6 milligram which represents 9.4 per cent of the normal level. However the readings at this time still elicit a 5.1 per cent elevation of normal. From the previous rate of removal we may infer a decrease to normal within another hour. Comparison of the rapid decrease in blood amino acids after intravenous infusion and the gradual slow decrease found with subcutaneous projects the idea of a gradual absorption of protein solu-

TABLE III.—AVERAGE BLOOD AMINO ACID LEVELS, DIFFERENCES, AND PER CENT OF NORMAL CHANGE FOR TEN CASES RECEIVING 500 C.C. OF PROTEIN HYDROLYSATE SUBCUTANEOUSLY IN ONE AND ONE-HALF HOURS

	Ambao seed	Difference	Per cent of normal change—above normal—%	Difference in per cent of normal change—%
Normal level no /mgm	6			
After 30	6	+0.3	4.9	+4.9
After 900 c.	6.9	+0.5	3	+8
After 36 hour	7	+1	16.3	+15.5
After 1 hour	6	—0	13	—4.3
After 36 hours	6.7	—0		—3
After 10 hours	6.4	—0.3	5	—4.9

tions over a long period from the subcutaneous tissues after injection. These findings also imply that 4 to 6 hours are required for the infusion and absorption of 500 cubic centimeters of protein hydrolysate by this route.

Further interpretation with analysis of the amino acid levels obtained by subcutaneous infusions of a 5 per cent solution of protein hydrolysate of bovine blood is given in Table III.

The urinary findings in the administration here described are not revealing for there was not any significant increase in the total nitrogen excretion for the 24 hour period and also amino acids were not detectable in the urine specimen (Table IV).

*Leg measurements and rate of absorption as determined with phenolsulfonphthalein excretion as an indicator after the subcutaneous infusion of 1000 c.c. protein hydrolysate in two and one half hours.* A group of 5 uncomplicated ambulatory surgical patients was used for this investigation. Urine analysis of each patient before the test did not reveal any abnormal findings and blood urea nitrogen and non protein nitrogen values were within normal range.

Each patient was given a control test of

phenolsulfonphthalein the day before the injection of the 1000 cubic centimeters of hydrolysate solution with a similar quantity of the dye. This gave figures of excretion for each patient. These were then compared to excretion values obtained when the dye was administered with the hydrolysate solution subcutaneously; therefore, an estimate of absorption. The validity of repeating the same type of dye test under somewhat similar circumstances is implied by the knowledge that kidney function can be measured rather closely because there is a close correlation between different readings of the same test done on successive days.

The following is the description of the control test. The patients voided and the specimen was discarded. 1 cubic centimeter of phenolsulfonphthalein was injected subcutaneously into the anteromedial surface of the thigh. The patient drank 1000 cubic centimeters of water. Urine specimens were collected at 1 hour and 10 minutes, 2 hours and 10 minutes, and 3 hours and 10 minutes following the injection of the dye. The specimens were prepared as is outlined in the literature and compared to known standards for computation of the percentage of excretion (5).

TABLE IV—CHEMICAL URINARY VALUES AFTER SUBCUTANEOUS INFUSION OF 500 C.C. PROTEIN HYDROLYSATE IN ONE AND ONE HALF HOURS

[illegible]

TABLE V—AVERAGE LEG MEASUREMENTS AND EXCRETION OF PHENOLSULFONPHTHALEIN AFTER SUBCUTANEOUS INJECTION OF 1000 C.C. OF PROTEIN HYDROLYSATE IN TWO AND ONE HALF HOURS IN FIVE CASES

Time	7½ min.	8½ min.	After 1 hour	After 2 hours	After 3 hours	After 4 hours	Total excretion
Amount injected	500 c.c.	1000 c.c.					
Control c.c. PSP per cent excretion			49	5	8.6		79.6
1000 c.c. P.H. and 1 c.c. PSP subcutaneously per cent excretion of PSP	8	1	19	6	9	9	73
Per cent excretion of control	9.4	23.9	46.8	68.5	81	89.7	89.7
Leg measurements							
Right	+0.75"	+1.5	+1.33	+0.55"	+0.19		
Left	+0.75"	+1.5"	+1.0"	+0.5"			

The following day the absorption test, with 1000 cubic centimeters of protein hydrolysate subcutaneously to which is added 0.6 gram of phenolsulfonphthalein, is conducted on the same patient. The details of the test are: The patient voids and the urine specimen is discarded. 1000 cubic centimeters of protein solution containing the dye is injected into the subcutaneous tissues in an average time of 158 minutes or about 2½ hours at an infusion rate of approximately 6.25 cubic centimeters per minute; urine specimens were collected after the injection of 500 cubic centimeters after 1000 cubic centimeters, and 1, 2, 3 and 4 hours following the completion of the infusion. The percentage of dye excreted for each period was calculated by colorimetric comparison. Leg measurements were obtained on each thigh during and after the infusion at regular intervals until the visual distention had disappeared; lastly, the percentage excretion of dye found with each period after the subcutaneous infusion of the hydrolysate and dye was calculated in terms of percentage of the total amount excreted by the control test performed the day before. Phenolsulfonphthalein dye has been used as an indicator for absorption (1). The results are depicted in Table V.

An average of 49 per cent of the dye was recovered in the urine 1 hour and 10 minutes after the injection of 1 cubic centimeter of phenolsulfonphthalein. The individual findings varied between 40 and 60 per cent. This represents the largest amount of dye excreted

during the 3 hour period following the injection. The 5 cases revealed an average total excretion of 79.6 per cent and 85 per cent was the greatest amount per case.

The urinary excretion of phenolsulfonphthalein when injected slowly with 1000 cubic centimeters of protein hydrolysate is distinctly different from that seen in the control. One hour after completing the injection a 39 per cent dye excretion is seen whereas 49 per cent was recovered in the control test at this point. The average figures of excretion for the period during and 1 hour after the injection are 8 per cent after 500 cubic centimeters is infused, 12 per cent following the next 500 cubic centimeters infusion and 19 per cent in the first post infusion hour. Two hours after completing the infusion, 16 per cent of the dye is recovered, 9 per cent in the 3 hour period and 9 per cent in the last or 4 hour interval. Hence a total excretion of 73 per cent of dye injected is noted in a 6½ hour period—6.6 per cent less than the amount recovered in a 3 hour period after injection of 1 cubic centimeter of dye subcutaneously.

The excretion figures obtained with the injection of dye dissolved in 1000 cubic centimeters of protein hydrolysate infer a rather steady and even absorption but with a maximum period at the end of 500 cubic centimeters and 1 hour after the injection of 1000 cubic centimeters. An 89 per cent excretion of the control is found in the 6½ hour period. Further, 72 per cent of the total excretion during the 6½ hour period occurs in the 4 hour period following the infusion.

The leg measurements closely correlate the blood amino acid levels previously described and the aforementioned excretion studies for the subcutaneous infusion of protein hydrolysate. The maximum increase in girth is noted at the end of the infusion (+1.5 inches in each leg). The enlargement subsides to normal within 3 hours after the injection.

A maximum blood amino acid level at the end of the subcutaneous administration and for 1 hour thereafter and the maximum excretion of dye at the same periods, indicate maximum absorption during this period. The gradual decline in the blood amino acids, the excretion of dye and the leg size during the next 3 to 4 hours verify previous impressions of a slow rather steady absorption for fluid given subcutaneously. Since the absorption time of subcutaneous infusion is time consuming in adults it is likely that subcutaneous infusions should not be given more frequently than every 8 to 12 hours.

#### INTRAMUSCULAR ADMINISTRATION

The intramuscular route has been used chiefly for the injection of small amounts (1 c.c. to 10 c.c.) of solutions and drugs in adults. Muscle tissues are vascular and contain a large supply of lymphatics; hence absorption should be rapid and adequate. One of the early reports on the use of intramuscular route was that of Nassau in 1926 who described encouraging results. Later descriptions appeared in Germany (Stamm). Glaser recommended the lateral and anterolateral surfaces of the thigh.

Our interest in intramuscular infusions of large quantities of protein hydrolysate stemmed from the experience of the author with plasma intramuscularly and the discomfort associated with lengthy subcutaneous infusion. Patients on parenteral therapy alone require 3000 to 4000 or more cubic centimeters per day. In view of the hospital management of surgical patients the usual method of administering 3000 cubic centimeters of fluid per day is to give 1000 cubic centimeters intravenously in the morning, 1000 cubic centimeters subcutaneously in the afternoon and 1000 cubic centimeters intravenously in the evening. By this plan the patient is immobilized for at

least 6 to 8 hours of the waking period, if all of the infusions are administered with ease (1½ hours for intravenous and 2½ to 4 hours for subcutaneous). Thus the patient is able to move about for only 5 hours of his hospital day. If the infusions require longer periods, such as 3 to 4 hours for intravenous, one can readily see that the patient is on his back all day if he is to receive adequate fluid and nutrition.

**Technique.** One thousand cubic centimeters of protein hydrolysate can be infused into the vastus lateralis of each leg simultaneously within 30 minutes without undue discomfort. The site selected for the infusion is the lateral at a point midway between the anterior and posterior surfaces and at the junction of the upper and middle thirds. A 2½ inch No. 15 to 18 gauge needle is used with the bottle suspended 3 feet from the level of the thigh, a Y connection is used so that both thighs are injected at the same time. One per cent or 2 per cent novocain to the amount of 50 cubic centimeters is usually added to each bottle for local novocainization. It is best to have the legs flexed at the knee so as partially to relax the iliotibial band. The needle is thrust sharply at a 45 degree angle to the long axis of the thigh with the point directed upward or cephalad. After the fascia lata is pierced the needle is inserted into the substance of the muscle at a 15 degree angle to the side of the thigh. There is a sense of give when the needle pierces the fascia. It is important to keep the end of the needle away from the bone; the needle should not be submerged beyond the middle of the transverse diameter of the vastus lateralis at the point of injection. No taping of the needles to the skin is necessary as the fascia lata will tend to fix the needle. The stopcock in the set is opened wide and the fluid is allowed to pour in. The first 200 to 300 cubic centimeters are administered in a matter of 3 to 4 minutes. Not infrequently the patient complains of a sense of fullness in the legs and describes a smarting sensation which disappears after the infusion of about 300 cubic centimeters. The flow is then slightly decreased but still continues at a very rapid rate. As the last 200 to 300 cubic centimeters are approached, the flow decreases still more but

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TABLE VI.—BLOOD AMINO ACID LEVELS AND UREA NITROGEN AFTER RAPID INTRAMUSCULAR INJECTION OF 1000 C.C. PROTEIN HYDROLYSATE IN THIRTY MINUTES IN BOTH THIGHS

Case	1	2	3	4	5	6	7	8	9	10	Average amino acid	Average blood urea
Normal level 100 c.c./mgm.	6	6.4	5.8	6	6.3	6	5.9	6.5	6.4	6.6	6	7.4
After 1000 c.c. P.H. intramus. in 30 min	7.4	7.3	6.9	7.8	7.8	7.0	6.8	7.8	7	7.5	7.16	8
After 1 hour	7.6	7.5	7	7	7.6	7.3	7.5	7.8	7.3	7.7	7.4	6
After 2 hours	7.4	7.3	6.8	6.7	7	7	7.0	7	7	7.3	7	5.8
After 3 hours	6.4	6.7	5.9	6.3	7	6.4	6.5	6.7	6.6	6.6	6.5	8
After 24 hours	6.1	6.5	5.7	5.9	6.4	6	6	6.4	6.5	6.5	6.5	3

is not slow enough to count the drops accurately in the "vaco drip". There is a bulging in the lateral compartment of the thigh. There is no pain after the early part of the infusion but patients complain of a heaviness in the leg following the injection and this is frequently described as a "dead leg". This sensation disappears with absorption. Few patients have any difficulty with ambulation after the total infusion. In the early part of our experience with intramuscular infusions we gave 1000 cubic centimeters into each limb but this produced excessive distention and tension. This distention was occasionally severe enough to produce the leakage of fluid from the puncture site. Needles in which holes were bored in the sides were also tried. These needles permitted a faster flow than is seen with the standard needles.

One hundred and seventy intramuscular infusions of 1000 cubic centimeters of protein hydrolysate have been administered to 78 patients without recognizable local reactions, irritations or failure of absorption.

*Blood amino acid levels, urea nitrogen and urine chemical changes after rapid intramuscular injection of 1000 c.c. protein hydrolysate in thirty minutes.* This study was performed with 10 uncomplicated postoperative surgical patients. The liter of hydrolysate was administered in 30 minutes by the previously described technique. Blood samples were drawn before the infusion after the 1000 cubic centimeter injection 1 hour, 2 hours, 3 hours, and at the end of the 24 hour period following the administration. Fractional samples of urine were collected throughout the 24 hour period.

The individual amino acid levels, the average amino acid levels and the average blood urea nitrogen for the 10 individuals studied are presented in Table VI. As will be noted the maximum rise occurs at the end of the infusion and in the first hour following the end of the injection. A 15.4 per cent or +1.0 milligram per 100 cubic centimeters of serum rise is seen with the end of the injection. A maximum response of 1.4 milligrams developed in 1 case and the least effect was represented by a 0.9 milligram elevation for this period. One hour following the injection the average rise was 0.2 milligram above the previous level with total rise above normal of 19.3 per cent. Further analyses of the blood levels found at 1 hour after end of the infusion indicate no rise in 3 instances. During the next 2 hour period a decrease of 17.8 per cent is seen—in order the figures are 13 per cent and 4.8 per cent decreases. The amino acid blood levels are normal at the end of the 24 hour period. These figures indicate maximum absorption with the completion of the infusion and an almost equal absorption rate within the first hour following the injection. The rather precipitous decline in the second postinfusion hour shows that the greater percentage of the injected protein hydrolysate is absorbed within a 2 or 2½ hour period following the injection.

The average blood urea levels performed at the same intervals as the blood amino acids are not significant. Further the total nitrogen output for the 24 hours of study varied between 11.1 and 13.1 grams, and averaged

12.4 grams

A composite presentation of the above findings is illustrated in Table VII.

TABLE VII.—AVERAGE BLOOD AMINO ACID LEVELS, DIFFERENCES PERCENTAGE OF NORMAL CHANGE AND AVERAGE BLOOD UREA NITROGEN FOR TEN CASES AFTER RAPID INTRAMUSCULAR INJECTION OF 1000 C.C. PROTEIN HYDROLYSATE IN THIRTY MINUTES IN BOTH THIGHS

	Amino acid	Difference	Per cent of normal change—above normal	Differences in per cent of normal change	Urea nitrogen
Normal level 00 c.c./mgm.	6				4
After 1000 c. P.H. intramuscularly	7.46	+1.4	5.4	+43.4	12.8
After 1 hour	7.4	+	19.3	+3.9	6
After 3 hours	7	+0.8	13	-6.3	12.8
After 3 hours	6.5	+0.3	4.8	-8	8
After 24 hours	6				2

Average blood amino acid levels, leg measurements and rate of absorption as determined with phenolsulfonphthalein excretion as an indicator after the rapid intramuscular injection of 1000 c.c. of protein hydrolysate in about thirty minutes in 5 cases. The method of injection is as described. The procedure for investigation is similar to that related under subcutaneous infusions except for the following details: (1) control injection of dye (1 c.c.) was made into the vastus lateralis of the leg; (2) blood samples were drawn at the same intervals as the collection of urine samples.

The injection rate in this experimental study and in the other infusions performed for clinical indications is about 36 cubic centimeters per minute.

Table VIII demonstrates the findings.

The amount of dye excreted in the control test closely resembles the findings previously described in the subcutaneous group viz. 79.6 per cent in 3 hours in subcutaneous and

69.4 per cent in 3 hours in the intramuscular series.

After the intramuscular injection of the hydrolysate solution with 0.6 gram of phenol sulfonphthalein 32 per cent of dye is excreted 1 hour after the total infusion, 22 per cent at the end of the next hour, 11 per cent following the third hour and 2.2 per cent after 4 hours. In percentage excretion of normal the above figures represent in the same sequence, a 46 per cent, 77 per cent, 93 per cent, and 96 per cent excretion of normal.

Five hundred cubic centimeters of fluid or approximately 250 cubic centimeters in each leg causes an increase in size of 1.3 inches and with the total injection the thighs are increased to about 2.6 to 2.75 inches above normal. The thighs begin to decrease soon after the end of the infusion by about 1 inch an hour so that they have returned to normal size within 3 hours after the completion of the liquid infusion. Therefore, 1000 cubic centimeters of

TABLE VIII.—AVERAGE BLOOD AMINO ACID LEVELS, LEG MEASUREMENTS, AND EXCRETION OF PHENOLSULFONPHTHALEIN AFTER RAPID INTRAMUSCULAR INJECTION OF 1000 C.C. PROTEIN HYDROLYSATE IN FIVE CASES

Time	9 min.	17.8 min.	After 1 hour	After 3 hours	After 3 hours	After 4 hours	Total
Amount injected	500 c.	1000 c.					
Blood amino acid, mgm.		7.46	7.4	7	6.5	6 (24 hours)	
Control P.S.P. per cent excretion			4		6.4		60.4
500 P.H. and intramuscularly per cent excretion of P.S.P.			22		21		67
Per cent excretion of control			46	77	83	96	96
Leg measurements							
Right	+1.5"	+1.75"	+1.8	+1.4"			
Left	+1.3	+1.6	+1.8"	+1.7"			

fluid injected rapidly into the vastus lateralis is absorbed within a 2 or 2½ hour period. Hence one can administer intramuscular infusions of similar quantity every 4 to 6 hours.

A male patient with peritonitis from a perforated duodenal ulcer was given daily injections of 1000 cubic centimeters of protein hydrolysate solution in each thigh rapidly (30 minutes) for 7 successive days as part of his fluid therapy. A biopsy of the vastus lateralis was taken the day following the last injection. Gross examination of the muscle did not reveal any changes in color, striations or configurations. Microscopic sections showed normal muscle bundles. There was no separation of the muscle fibers, fibrosis, fragmentation, or cellular infiltration as evidence of inflammation or irritation.

#### ADVANTAGES AND DISADVANTAGES OF EACH ROUTE

In view of this report, it seems evident, that parenteral protein hydrolysate prepared by enzymatic digestion of bovine blood is a safe solution in surgical patients when given intravenously, subcutaneously, and rapidly intramuscularly. These findings verify an earlier report (12).

Intravenous administration of fluids is by far the most commonly used route. Though it has the advantages of direct introduction of medication and of ease of administration of large amounts at one time or continuously, it has numerous disadvantages. An intravenous infusion is only as effective as the flow through the needle, and the flow through the needle is directly related to the correct introduction of the needle into the vein. The ease or difficulty encountered with venipuncture is dependent on: (1) accessibility of the veins (collapsed or masked by subcutaneous fat) (2) size of the veins (3) thickness of the wall of the veins (4) degree of fixation of the vein (5) size of the needle in relation to the size of the vein, (6) sharpness of the needle, (7) the degree of bevel of the needle (8) cleanliness of the needle (9) experience of the individual doing the injection (10) position of the needle in the vein (complete incomplete angulation etc) (11) age of the patient (12) co-operation of the patient' (White, 13)

Though intravenous medications have been refined to reduce reaction incidences, the danger of reactions is still an imminent one. Most reactions depend on factors within the patient, those in the equipment, and those due to the solution. The reactions which may result from faulty equipment are due to pyrogens, contaminants rubber tubing, or alkalies. Too rapid infusions of solutions may cause overloading, pulmonary edema, or systemic reactions such as vomiting, flushing etc. These studies indicate that the tolerance of protein hydrolysate is great. As much as 25 to 30 cubic centimeters may be injected per minute in 1000 cubic centimeter doses without fear of frequent systemic reactions. Vomiting and nausea are seen only if 50 to 150 cubic centimeters per minute is injected in quantities of 700 to 1800 cubic centimeters. A recent report by Smyth and associates indicates that the incidence of nausea with hydrolysates depends on the amino acid composition rather than on the average rate of administration or on the plasma amino acid nitrogen level. This author also indicates that there may be a close relationship between glutamic and aspartic acid contents with nausea and vomiting after intravenous injection. The solution studied and presented herein contains 10.34 per cent glutamic acid and 4.26 per cent aspartic acid.

After the injection of 50 grams of protein hydrolysate intravenously at 17 cubic centimeters per minute there is an average rise of 2.6 milligrams of amino acids per 100 cubic centimeters of serum or a 42.2 per cent elevation above normal. Two hours later the major part of the circulating amino acids is removed. A point of interest is the slight decrease during the first postinfusion hour and the maximum removal in the next hour. Hoffman Kozoll and Osgood report the following findings with "parenamine." Injection of 45 grams of parenamine intravenously at slow speeds produced an average plasma amino acid rise of +4.9 milligrams per 100 cubic centimeters during the injection with a return to normal in 2 hours. The difference in our amino acid levels and those reported by Hoffman and associates may be partially due to the difference in amino acid content of the two preparations. The preparation of protein





preoperative and postoperative surgical patients there were 0.72 per cent reactions 0.14 per cent were systemic, 0.49 per cent were pyrogenic, and 0.09 per cent were allergic. The systemic reactions were seen only with the first batch of material investigated in the early part of the investigation. The average rate of infusion varied between 12 and 17 cubic centimeters per minute, a speed commensurate with practical administration of fluids.

4. No acute ascending thrombophlebitis or ascending thrombosis was found in any case receiving 1000 cubic centimeter infusions in 1 or 1½ hours even though repeated infusions were given on subsequent days in either antecubital veins. A procedure for decreasing the local thrombosis and the disadvantages of prolonged infusions are presented.

5. The blood amino acids rise 2.6 milligrams per 100 cubic centimeters or 42.2 per cent above normal after the infusion of 1000 cubic centimeters of protein hydrolysate in 1 hour. Two hours is required for the removal of excess amino acids accumulating in the blood after the injection. No increase in urinary nitrogen or amino acids is found in the urine with the intravenous administration of 1 liter of hydrolysate solution.

6. Four hundred and twenty subcutaneous infusions of 1000 cubic centimeters were given at a rate of 6.25 cubic centimeters per minute in 126 patients without failure of absorption or local difficulties.

7. Subcutaneous infusions of 500 cubic centimeters of protein hydrolysate in both thighs and in 1½ hours cause a 13 per cent rise in blood amino acids with an average maximum rise to 6.91 grams per 100 cubic centimeters. This rise continues in the next 30 minutes but then decreases and has returned to normal 2 hours after the end of the injection. Absorption studies as indicated by the excretion of absorbed phenolsulfonphthalein indicate that 6½ hours are required for the introduction and absorption of 1000 cubic centimeters of protein hydrolysate. Hence only 1000 cubic centimeters of fluid can be given every 8 to 12 hours by the subcutaneous route.

8. A method of estimating absorption of fluids from subcutaneous and intramuscular

tissues with the excretion of absorbed phenol sulfonphthalein is presented.

9. One hundred and seventy intramuscular injections of 1000 cubic centimeters of protein hydrolysate in 78 patients at a rate of 33 cubic centimeters per minute show rapid absorption in 3 hours, no irritations or local reactions, no failure of absorption and a negligible amount of pain or discomfort.

10. Blood amino acid levels, after the intramuscular injection of 1000 cubic centimeters in 30 minutes indicate a maximal rise at the end of the infusion and a decrease to near normal within 3 hours after the injection. Absorption studies reveal similar findings in which 93 per cent is absorbed in 3 hours after the rapid infusion of 1000 cubic centimeters into the vastus lateralis.

11. Pathologic slides do not show any abnormal tissue reaction in a patient who received into the same leg 1000 cubic centimeters on 7 consecutive days.

12. A comparison of intravenous, subcutaneous intramuscular infusions is made and the advantages and disadvantages of each route are discussed.

13. Bovine protein hydrolysate is a safe parenteral fluid for patients who require proteins by intravenous, subcutaneous and intramuscular routes.

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## SURGERY Gynecology and Obstetrics

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### CONGENITAL OBSTRUCTION OF THE BILE DUCTS

**I**N recent years, a greater interest in surgical conditions of infancy and childhood has resulted in the increasing number of congenital anomalies that are reported. With increasing experience successful results are being obtained in the surgical treatment of these conditions, many of which, 30 years ago were uniformly fatal. Developmental anomalies causing obstruction in the extrahepatic bile ducts are examples of these conditions. Jaundice in the newborn is a very common finding and the case of jaundice that is the result of a congenital obstructive lesion in the extrahepatic ducts must be recognized in treating icterus in early life. This diagnosis may be difficult to establish in the first two to three weeks of life. Fortunately as far as prognosis goes it is not essential that diagnosis be established this early. The prognosis seems equally favorable in those cases that are amenable to surgical treatment even though the diagnosis is not established for several

weeks. It is desirable however that these infants be operated on before the fourth or fifth week of life. While the treatment in these cases is surgical, there is always ample time to be sure of the diagnosis.

The diagnosis is made largely by the exclusion of other causes of jaundice in early life. The differential points are usually easily determined. The following causes must be considered and excluded. Icterus neonatorum, or physiologic jaundice is generally not serious and usually disappears between the second and third week of life. While the degree of icterus present in physiologic jaundice may at first be the same as that in obstructive jaundice it does not progress. There is seldom an enlarged liver and the jaundice soon starts to subside. The stools contain bile and there is seldom bile in any large amount in the urine.

Icterus due to erythroblastosis fetalis comes on early and examination of the blood smear may show an increased number of erythrocytes. The spleen is enlarged rather early in this disease which is not the case in congenital obstruction of the bile ducts. Appropriate laboratory tests of the child's and the mother's blood will promptly confirm or exclude the presence of Rh incompatibility and any abnormal antibodies. In erythroblastosis fetalis, unless suitable treatment by appropriate transfusion is instituted there may be an early fatal outcome. However it is well to remember that in the recovery stage of erythroblastosis fetalis with jaundice there may be an obstructive phase due to severe liver damage. If the suitable laboratory tests of the child and mother as referred to above have not been done they should be performed at this stage to rule out this possibility as a cause of the icterus.

Icterus in the newborn caused by hemolysis whether from sepsis or from hemolytic crises, is not accompanied by the acholic stools characteristic of congenital obstruction of the bile ducts, nor is there a significant amount of bile in the urine. The icteric index is not increased and the symptoms are not, as a rule, progressive. In familial hemolytic icterus there is a striking increased fragility of the red blood cells which is the important laboratory finding.

Syphilis as a cause of jaundice, will be shown by appropriate examination of the patient's and parents' blood and usually the x-ray examination will give confirmatory evidence of syphilis in the patient's bones.

In congenital obstruction of the bile ducts, the jaundice is prompt in appearance, often being present at birth or very shortly thereafter. Characteristically it becomes slowly but progressively more intense as the days and weeks pass and it has a rather peculiar greenish yellow color rather than the bright yellow tinge seen in other types at this age. The stools are clay colored or white, show no bile from the start and continue to be acholic. Very occasionally, a positive test for bile may be obtained or the stool may show gross evidence of bile on the surface. Such findings have been observed in our series where operation has proved that there was atresia or even complete absence of the extrahepatic ducts. To explain this finding it is presumed that a certain amount of bile may be excreted into the gastrointestinal tract from the intestinal mucosa, the bile being carried there by the blood stream.

Cases of congenital atresia show no evidence of sepsis as a cause for the jaundice unless there be a concomitant infection. The icteric index is elevated. In our series these ranged from 50 to 325, the average being 150. The fragility of the red cells is normal or even de-

creased. The urine is dark colored and will persistently give a positive test for bile pigment.

In other words, the diagnosis is arrived at with considerable certainty by excluding other causes of jaundice. In doubtful cases nothing is lost by waiting a sufficient period of time to exclude these causes. The general condition of these patients remains surprisingly good even after two to three months. It is however desirable to operate as soon as the diagnosis is established which is usually possible by the fourth week. Unless the condition is very advanced abdominal findings are confined to an enlarged liver, the edge of which may extend well down below the costal margin. It is sometimes possible to feel the roughening characteristic of biliary cirrhosis. Ordinarily the spleen is only slightly enlarged, if at all. In advanced cases ascitic fluid may be present. The state of nutrition is usually surprisingly good, though the older infants may give some history of fat intolerance when on the ordinary formula for their age. Blood studies rarely show anything other than a secondary anemia. Surprisingly enough the clotting time is seldom increased, particularly in infants under two to three months of age. The prothrombin values may be somewhat lowered though this is not always the case. The infant shows nothing like the profound toxemia that is usually present when the icterus is due to sepsis. The gross findings associated with these obstructions are a generalized persistent and increasing icterus with a gradually increasing size of the liver.

The treatment is surgical. The extrahepatic biliary system should be very carefully inspected through an incision of adequate length, preferably a right rectus incision. The procedure takes time and must be done with great care and with particular attention to the control of hemorrhage. The gall bladder is sought for first and if present is followed down to the

area of the hepatic and common duct. If the gall bladder obviously contains bile, the prognosis for that individual becomes much more favorable. Oftentimes, the gall bladder is rudimentary and even when it has a lumen it may prove to contain only a clear viscid fluid with no bile pigment, which indicates that there is no communication between this organ and the other extrahepatic ducts. Distention of the gall bladder with saline solution may give valuable information as to whether it communicates with the hepatic and common ducts. If these ducts communicate but are very small such distention permits of their easier identification. The gall bladder may be absent. A great variety of anomalies may be encountered. The essential finding as far as the chance of successful surgery is concerned is the presence of the hepatic duct. If nothing in this region can be found, the prognosis is hopeless. Even a very small hepatic duct can be successfully anastomosed to the duodenum and this is usually best done over a small piece of soft rubber catheter which should be not more than two centimeters in length. A longer tube may not be passed with ease after healing has taken place. If the hepatic duct, a cystic duct, and a gall bladder are present and continuous the operation of choice is to anastomose the gall bladder to the duodenum. This procedure is far better than anastomosing it to the stomach. If there is any appreciable length to the common duct, however it is better to anastomose the common duct to the duodenum.

The usual careful attention to preoperative and postoperative care, particularly as regards fluid and electrolyte balance must be observed. In about one fifth of the cases, the structural anomaly present will permit of some successful anastomosis between the extrahepatic ducts and the gastrointestinal tract. In the remaining and discouragingly large percentage of

cases however no extrahepatic ducts are present. Many measures have been employed in such cases to create an artificial communication between the liver itself and the gastrointestinal tract. These efforts are usually futile, because postmortem examination of patients who have no extrahepatic ducts, does show in a large percentage of cases, an associated intrahepatic developmental pathology of such a degree that there is practically speaking no biliary tree of sufficient size or development to permit any form of anastomosis between the liver and the gastrointestinal tract that will effectively drain bile.

The infants who have been successfully operated on however have shown a very satisfactory development. They have not shown evidence of liver damage for as long as 15 years after operation. This is surprising when one considers the apparently advanced state of cirrhosis present at the time of operation. It has been particularly interesting that they have not shown any notable tendency for a retrograde cholangitis, even though the stoma between the bile duct and the intestine has, in most cases, been relatively large and presumably with a complete absence of any sphincter action. In infants who have had the gall bladder anastomosed to the gastrointestinal tract we have, as yet no cases where stones have developed. It is too soon to state, and futile to predict, how many will form stones.

We believe that all infants with congenital atresia or stenosis of the bile ducts should be given the benefit of an exploratory operation. The diagnosis is relatively easy to establish and even though only 20 per cent or less will be found to have a condition that can be remedied by surgery it is worthwhile to make the attempt. The prognosis without operation, is uniformly fatal though these patients may live for a surprising number of months.

THOMAS H. LANKFORD

## CONGENITAL ANOMALIES OF THE BILE DUCTS AND ADJACENT BLOOD VESSELS

**I**N no region of the human body are anomalies so common as in the bile ducts and adjacent blood vessels. It is therefore, impossible to present any pattern as the "normal" a composite of specimens least abnormal becomes the substitute for normal anatomy in this area. It is likewise true that in no region of the human body do anomalies result in so many serious accidents or consequences following surgery. Although carelessness and haste are vital causes of accidents resulting in stricture or absence of the common duct, the majority of these accidents would probably not occur if there were not such a great variation in anatomy.

In 39 cases of stricture of the common duct observed at Illinois Research Hospital over a 10 year period operative trauma was definitely identified as the cause of the stricture in 64 per cent. In an additional 20 per cent of cases jaundice developed 4 months to 5 years following cholecystectomy. Although inflammation of some type may be considered to be the cause of stenosis in this group, the fact remains that a gall bladder operation (cholecystectomy in every instance) preceded stricture formation. Other surgeons report similar figures relative to operative trauma as the etiologic factor (Cattell, 80 per cent, Walters 90 per cent). In 13 per cent of our series chronic sclerosing pancreatitis was the cause of the stricture. In only one patient (3 per cent) was there no history of operation preceding the stricture the cause of obstruction in this instance was an adhesion compressing the duct without actual fibrosis or damage to the duct wall. Causes of stricture not related to anomalies are ulceration of the duct by stone, chronic sclerosing pancreatitis neglected cholangitis

and abscess about the duct. Rarely indeed can choledochostomy be identified as the primary cause of stricture.

Extreme mobility of the common duct is a common cause of injury to this structure particularly if the cystic duct is short and wide. In this case traction on the gall bladder will make the cystic and common duct appear as one continuous structure (namely cystic duct). If more than average care is not exercised by the surgeon, he may thereby identify the common duct as cystic and ligate it, thus producing a complete obstruction of the common duct. On other occasions the cystic duct is long and lying against the common, as was noted in 20 to 25 per cent of cases by Eisen drath. Strenuous efforts to separate it from the common duct may result in so much damage to the latter structure that a stricture develops later. An accessory hepatic duct (noted by Flint in 15 per cent of cases) may give rise to stricture of the common duct by a mechanism not generally appreciated. If the accessory duct is cut unknowingly during cholecystectomy and not ligated, bile may accumulate around the common duct after operation and give rise to so much inflammation in the wall of the duct as to result in stricture formation at a later date. Section of an accessory hepatic duct is very apt to be unnoticed because flow of bile is commonly decreased to a marked degree during the operation thereby depriving the surgeon of the best method of detecting its division. Although abscess formation about the common duct is no doubt an important cause of stricture the author is convinced that accumulation of bile is probably a more common cause.

Arterial anomalies give rise to strictures of the common duct primarily because the duct is injured during the process of stopping hemorrhage from the injured anomalous vessel. In 15 per cent of cases (Flint), an accessory

cystic artery is present. After the surgeon has identified one cystic artery and ligated it, he is apt to proceed rapidly with the rest of the dissection and during this haste cut the other cystic artery. Division of either cystic artery will give rise to hemorrhage immediately adjacent to the common duct. If the surgeon should lose his presence of mind, and begin to stab blindly in the bloody field for the bleeding artery instead of controlling the hemorrhage by insertion of his index finger in the foramen of Winslow with compression of the hepatic artery against his thumb the common duct may be caught and ligated with the bleeding vessel. In 16 per cent of cases (Flint) the cystic artery is anterior to the common duct. The surgeon does not expect to find the artery in this location and during the process of incising the peritoneum and fibrous tissue over the common duct may cut the cystic artery. Control of the hemorrhage by improper means, as mentioned above, may likewise result in ligation of a portion of the common duct with the bleeding vessel. In 12 per cent of cases the right hepatic artery crosses to the right anterior to the common duct (Flint). In about 20 per cent of cases it proceeds from its normal position under the common duct to the right and anteriorly so that it parallels the cystic duct. In either of the two positions just mentioned it may be injured during dissection. In either case hemorrhage will be brisk. If the hemorrhage is not controlled skilfully and the bleeding point ligated carefully the common duct may be damaged. However in about 50 per cent of cases division and ligation of the right hepatic artery will result in death of the patient within a few days following operation. In these cases there will naturally be no opportunity for development

of a stricture. In 20 per cent of cases the gastroduodenal artery lies anterior to the common duct (Eisendrath). Although this vessel usually lies too far inferior to the area of dissection to be damaged, it might easily be injured if the surgeon should carelessly attempt to isolate the distal portion of the common duct. Hemorrhage would be very brisk and its control might result in injury to the wall of the common duct. In about 50 per cent of cases there is a small branch of the right hepatic or gastroduodenal artery in the anterior wall of the common duct. Although this artery is usually severed when the duct is opened for extraction of stones the resultant hemorrhage is rarely severe enough to result in significant damage to the duct during control of the bleeding joint.

About the only anomaly of the gall bladder giving rise to stricture of the common duct is an unusually large and pendulous Hartmann's pouch which lies on the common duct. Since adhesions are common in this area, it is obvious that damage may be inflicted on the common duct unless separation of the pouch from the common duct is carried out with extreme care (R. Graham).

In about 90 per cent of cases the portal vein bifurcates before entering the liver and in the remainder of cases enters the liver before bifurcation. Rarely is this anomaly related to injury or stricture of the common duct. The common hepatic duct bifurcates inside the liver in about 90 per cent of cases, and outside the liver in the remainder. This anomaly also is seldom related to injury to the duct itself but when the hepatic ducts join outside the liver and a stricture is present at this site the repair is greatly complicated by the anomalous bifurcation. WARREN H. COLE.

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## THE BOOK SHELF

### WALT WHITMAN — A CASE HISTORY

JOSIAH C TRENT M.D., F.A.C.S., Durham North Carolina

WALT WHITMAN the Good Gray Poet the poet of democracy has been the center of many controversies since the publication of his *Leaves of Grass* in 1855. Although Walt was the prophet of the perfect body—*I sing the body electric*—the last 30 years of his life were dogged by ill health. He finally died 2 months before his 73rd birthday, a veritable pathological museum. Although there are many references to the state of Whitman's health particularly during the later period of his life, these are largely superficial and subjective. Examination of the available records, however, has allowed us to reconstruct, at least in outline, the tremendous struggles waged by one of our literary giants against physical and mental deterioration.

Walt Whitman was born at West Hills, Long Island, on May 31, 1819, the second of 9 children. His father, Walter Whitman, was a farmer and carpenter. When Walt was 4 years old the family moved to Brooklyn, then a village of about seven thousand inhabitants. He was educated in the common schools of Brooklyn and at 13 left school and began work as an errand boy in a doctor's office. Before reaching 15 he became an apprentice typesetter in the printing office of the *Long Island Patriot*; at 18 he tried teaching for a time in Long Island country schools but in 1839 he turned again to printing, now as publisher of his own newspaper, *The Long Islander*, in Huntington. After a year or two he gave up the paper and returned to Brooklyn where in 1841 he became editor briefly of the *Daily Aurora* at the same time writing essays, stories, and poems for other newspapers and magazines. In 1842 he wrote a temperance novel *Franklin Evans*. All these productions, whether prose or verse, show very little of the distinctive manner that was to mark Walt's

later writings; they show, in fact, very little merit of any kind.

With frequent vacations on rural Long Island, Whitman remained in Brooklyn and New York until early in 1848 when, having lost his post as editor of the *Brooklyn Eagle*, he set out for New Orleans to become editor of a newly established paper there. After a few months he returned to New York where he continued to work as editor and writer and for a time as carpenter. In the spring of 1855, at the age of 36, at a Brooklyn printing house he began to set type for a book of poems he had written and in July the first edition of *Leaves of Grass* appeared.

This amazing publication utterly different from almost all he had earlier published met for the most part with indifference or contempt in the literary world. Praise came chiefly from Emerson who wrote in a letter to Whitman: "I find it the most extraordinary piece of wit and wisdom that America has yet contributed. I greet you at the beginning of a great career." The most truly appreciative reviews were written by Whitman himself.<sup>1</sup>

Further editions of *Leaves of Grass* appeared in 1856 and in 1860, the latter from a Boston publishing house which collapsed with the coming of the Civil War. Walt's brother George enlisted promptly when the war began while Walt stayed quietly in Brooklyn writing poetry and visiting sick and disabled stage drivers in the hospitals. In December of 1862 when word came that George had been wounded, Walt left for the front. He found George nearly recovered but encountered many sick and helpless soldiers who needed his care accordingly he stayed in Washington to

He published anonymously several reviews, one of which began: "An American bard at last! One of the roughs, large, proud, affectionate, eating, drinking, and breeding; his costume manly and free; his face sunburnt and bearded; his postures strong and erect; his voice bringing hope and prophecy to the generous races of young and old. If health were not his distinguishing attribute, this poet would be the very harlot of per sons." (18)

From the Division of Thoracic Surgery, Department of Surgery, Duke University School of Medicine and Duke Hospital, Durham, N. C.





Fig. Whitman in July 1854, at the age of 35

serve as volunteer nurse in the hospitals. This activity he carried on for 3 years, meanwhile holding various government positions and corresponding with New York papers. In the summer of 1863 when the hospital work appeared to be affecting his health he decreased somewhat the number and length of his visits, but by the end of the war he computed that he had made six hundred visits, seeing over eighty thousand sick and wounded soldiers.

After the war Whitman stayed on in Washington, working as a clerk in government offices and writing and publishing new editions of *Leaves of Grass*. In 1873 at the age of 54, he suffered a severe paralytic stroke. When he had partially recovered, he set out for the Jersey coast to avoid the summer heat of Washington, but broke down in Philadelphia and was taken to the home of his brother George in Camden. In this town he spent the greater part of his remaining years, at first with George, then in his own home on Mickle Street. Here he prepared further editions of the *Leaves* the chief being those of 1881-1882 and 1891-1892. For long periods he was an invalid, confined to his room at times he was stronger and able to travel, to the West, to Canada, to Boston and New York. During these years his literary reputation, which had received its first real impetus

from his recognition by English literary lights in the sixties, grew ever wider though his poetry was not to receive general acceptance until the twentieth century. He had a small coterie of fervent admirers, among whom was the Canadian physician, Richard Maurice Bucke, who first visited Whitman in July 1877 and became one of the poet's closest friends as well as his principal medical adviser. After an illness of four months' duration, Whitman died on the 26th of March, 1892.

#### CASE SUMMARY

##### Family History (3)

**Father** Walter Whitman (1789-1855). Died after an exhausting illness of nearly 3 years from paralysis. His death was easy and unconscious.

**Mother** Louisa Van Velsor Whitman (1795-1873). Her letters to Walt in the sixties complain often of "numbness in the right arm, which was 'swollen and painful' (arthritis) also of 'dizziness in my head, 'moroseness and distress in my side' and 'bad coughing' (November 9, 1867). Cause of death unknown.

**Brother** Jesse Whitman (1818-1870). Had cardiovascular and central nervous system syphilis. In the last few years of his life became violent and was judged insane. He was confined to King's County Lunatic Asylum, Brooklyn, New York, here he died of "rupture of an aneurism."

**Sister** Mary Elizabeth Whitman Van Nostrand (1811-1899). Had arthritis. Cause of death unknown.

**Sister** Hannah Louisa Whitman Heyde (1817-1906). Was considered psychoneurotic. In 80 had mild paralytic stroke. Died in her 85th year of pulmonary edema, mitral insufficiency, valvular disease of the heart and chronic nephritis.

**Infant** Born April, 1815—died September 1815. Cause of death unknown.

**Brother** Andrew Jackson Whitman (1806-1863). Had chronic disease of the "throat and bronchia" which probably was tuberculosis. Walt lived in the same house with Andrew until shortly before he left for Washington in 1863.

**Brother** George Washington Whitman (1809-1904). In 1865 after George returned from the Army he was very sick for time with "hung fever." During 1865 he had "headaches and face was bloated for time." He also had rheumatic pains in his legs and hips. In 1899 George was sick and paralyzed.

**Brother** Thomas Jefferson Whitman (1815-1890). Died of "typhoid pneumonia (tuberculosis?)" Jeff married Martha E. Mitchell (1850) who died in 1873 of tuberculosis. Walt had close contact with Jeff and his life until he left for Washington.

**Brother** Edward Whitman (1815-1892). Eddie was ever normal. Apparently he had birth injury which left him with a crippled left hand and a paralyzed leg.

At the age of three he had scarlet fever which left severe after effects. He was also feeble-minded and an epileptic. He died in Blackwood Sanatorium, New Jersey of "valvular heart trouble."

##### Marital history

Walt never married although, according to his own statement, he had several illegitimate children (3, 14).

##### Post history

In his youth Walt presumably had no serious illnesses. He developed (1833-45) into "healthy strong youth."

(grew too fast though, was nearly as big as a man at 15 or 16) The years 1846, 47 and there along see me still in New York city working as writer and printer having my usual good health (16) His "usual good health" continued until about 1858 when he suffered from a "sunstroke"

(17) the details of this illness are unknown but it probably was the first of a subsequent series of minor strokes. He recovered apparently uneventfully and continued well except for colds. In April, 1863 he wrote his mother "I weigh about 200, and as to my face (so scarlet) and my beard and neck, they are terrible to behold. I fancy the reason I can do some good in the hospitals among the poor languishing and wounded boys, is, that I am so large and well—indeed like a great wild buffalo with much hair" (19)

Except for numerous colds accompanied by slight deafness, Walt remained fairly well until June 1863, when he complained of quite an attack of sore throat and distress in my head" (18) In July 1863, while assisting at the amputation of a gangrenous limb of a Virginia Union soldier to whom he was much attached, he sustained a cut of the right hand. His hand became inflamed and swollen, and red streaks ran up to the shoulder (10) The infection subsided in approximately 4 to 5 weeks but left him so extremely weak and debilitated that he was advised to desist from his hospital visits for a while. He improved rapidly and on August 11 1863 was again able to write his mother that he felt better than he had in 6 weeks. About the wound in my hand and the inflammation, etc. it has thoroughly healed" (19) During the summer of 1863 Walt began to complain that the sun affected him, causing aching and fulness on the head (17) He resumed nursing the soldiers, however, and in January 1864, was "well and fat and weighed about 200" He continued to complain of "fullness of the head" particularly in hot weather and "spells of deathly faintness." He was again advised that he had continued too long in the hospitals" and that he should not go "inside the hospitals for the present" (19) His spells continued with increasing frequency until finally in July 1864 he was "prostrated." Following this rather severe attack the "unconscious and perfect health" he formerly had was gone. It was his "first appearance in the character of a man not entirely well" (14) His spells persisted and in August and September 1866, he had an other severe attack which left him "prostrated and dead, weak," with little use of his limbs (13) He recovered satisfactorily and except for numerous severe colds remained well apparently until 1872 when he began to complain again of those "spells in the head" which had troubled him at intervals since 1864, and on January 24, 1873, he awoke to find himself paralyzed on the left side. He was placed under the care of Dr. W. B. Drinkard<sup>3</sup> of Washington, D. C., who gave him general supportive treatment, followed later by electric stimulation to his paralyzed side

<sup>3</sup>William Beverly Drinkard (1829-1877) was born in Williamsburg, Virginia, the son of William R. Drinkard, Assistant Secretary and later acting Secretary of War under Buchanan. He received his education at Georgetown College, Washington, D. C. and the Lycée Impériale, Orleans, France. In November 1866 he began the study of medicine at Paris. Here he assisted in Desmarres Clinic where he studied principally diseases of the eye. He studied also under such other eminent teachers of the time as Velpeau and Flourens. In July 1867, he went to London for several months and in the autumn of the same year returned to Washington where he entered the National Medical College from which he received the M. D. degree 1 March, 1866. In

1871 he was elected professor of anatomy at the National Medical College, a post he held until his premature death 5 years later. Although trained in ophthalmology he did not confine himself to this specialty but engaged in the general practice of medicine. He was one of the founders of Washington Children's Hospital. (8)

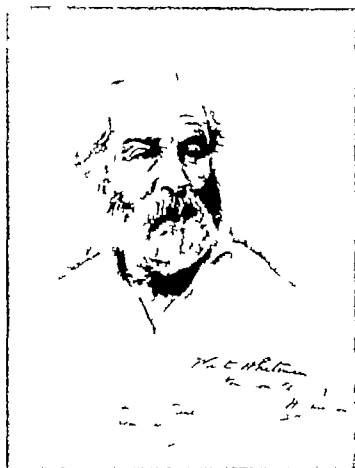


Fig. 2. Whitman at 44, in 1863.

After he had recovered sufficiently Walt started for the New Jersey shore to recuperate but broke down in Philadelphia and had to be taken to the Camden home of his brother George (10) Apparently Walt asked Dr. Drinkard to send his case report to Dr. Matthew Grier<sup>4</sup> of Philadelphia, whom he saw several times.<sup>5</sup>

Dr. W. B. Drinkard to Dr. Matthew Grier Washington City July 4, 1873. Autograph letter in the Trent Collection, Duke University Library (15) The letter reads as follows

My dear Doctor—

I am informed by M. Whitman, lately a patient of mine, now on a visit to Camden, that he intends to avail himself of your counsel and treatment before returning to this city and he requests me to let you have short statement of the history of his case up to the present time. It may be briefly stated thus. On the 3d of January—7 February—last M. W.—previously in good health—was attacked with left hemiplegia, presenting all the symptoms of such conditions, though none of them very marked at any time. Speech was hardly appreciably impaired facial distortion very slight, & deviation of tongue just perceptible left arm extremely never wholly useless, left lower showing the parietic condition more than any other part or organ. Constipation slight at onset of attack, has required little attention subsequently.

Under the influence of rest, and such incidental treatment as was demanded from time to time, his general condition has slowly improved locomotive power having, however been only imperfectly regained. His principal annoyance has been a recurrent headache, with tendency to nausea—never actually reaching the latter point (preceding ten words cancelled by Drinkard).

After subsidence of everything like active manifestations, I commenced, cautiously the use of the Induced Current—with Galiffe's battery—and continued it for a number of weeks, without apparent result, beyond a decided improvement in nutrition of the lower limb. When he was on the point of leaving, I sug-



Fig. 3. Whitman 1853, in 87

gated to him the possible benefit to be derived from the use of the combined current and I think it is with reference to that more particularly that he wishes to consult you.

Dr. Whitman probably would not have lost of the tastes & mental constitution. I think the most natural I have ever encountered and for those things go, he has all his for our. Beyond this, the prognosis is, of course, of the stereotyped water-tamity characteristic of such cases. He has occasionally taken pot-bromide & iod. bromide for his headaches for short time took the phosphates of iron, quinine & strychnine. Some occasional mild laxative—as ether drops that I recollect.

Hoping that you may be able to help Dr. Whitman in regaining the bodily independence on which his usual mental helpfulness very much depends. I am, my dear Doctor,

Very truly Yours,

Wm. B. DRYDEN

Matthew J. Grier (1818-1901) as born in Philadelphia of Scotch Irish ancestry. He received his M.D. degree from the University of Pennsylvania in 1860 (8).

An incomplete manuscript not by Whitman (5) concerning visit to Dr. Grier is in office here. Jan. 74 visited Dr. Grier again today at 3-8 st. at Phil for consultation.

He reiterated his theory that any sufferings (later ones) come nearly altogether from gastric, stomachic, intestinal, now excretory & causes, causing flatulence, very great distension of the colon, all g of passages, weight on valves, crowding & press on organs, (heart, lungs, etc.) and the very great distress & pain I have been under in breast left side & pit of stomach, & thence to my head, the last month. Advised me by all means to begin the use of an injective syringe (Fountain N. rapid ter for clysters)—was favorable to my evening walking—advised val foot-jala pills. 302—Kneading the bowel.

Under Dr. Grier's care Walt improved gradually but in July 1883 had another attack which left him a year later "scarcely able to get up and down stairs" (3). It was at about this time that Dr. William Osler at Dr. Bucke's request paid Walt a professional visit. The poet had recovered from his paralytic attack of 13 years before and had only slight residual weakness in his left leg. After careful examination Osler told Walt that "the machine as in fairly good condition considering the length of time it had been on the road" (7).

Whitman's fairly frequent "sick spells" during the late seventies and early eighties culminated in June, 1888, in another severe paralytic stroke. Bucke, who happened to be in Philadelphia at the time, took Osler with him to see Walt. They found him in bed, conscious but mentally confused and with the speech slightly blurred and indistinct. There was no fever and the pulse was good. He had had one or possibly two attacks of transient unconsciousness with difficulty in speaking such as now known are not uncommon with sclerosis of the arteries of the brain. For week or more the condition looked doubtful, but he gradually improved and recovered without any permanent paralysis or loss of speech (7).

Although Walt appeared to have recovered from this attack satisfactorily, his course continued downhill. In addition to his usual complaints of headache, lassitude and inertia, for the first time he began to complain of "indigestion" and "bladder trouble" (see Review of Systems). On March 8, 1890, Dr. Bucke asked Dr. Daniel Longaker of Philadelphia to see Walt professionally. He found Walt an old man, who complained of constipation, lack of energy, "inertia," urinary frequency and urgency. His apparent age was greater than his real years. Remote memory was better than recent. He moved about awkwardly with the aid of his cane. Muscular strength in the upper extremities was normal, no ataxia or incoordination. Heart and lungs were in good condition. Little sclerosis of temporal or radial arteries.

Walt was treated expectantly with massage, leeches, and catheterization, but continued in poor health until the onset of his Present Illness in December.

#### Review of Systems

##### Head. See Past History.

Eyes. Walt did not wear glasses and apparently had good vision until late in life.

"The following notes (5) written by Dr. Grier indicate the treatment administered to Whitman:

R/Syr Calc lactophosph 3 /  
Sug 14 teaspoonful after  
breakfast & dinner  
8 73 Grier  
R/40 53  
Sodium lactate 3p  
Glycerine 3 T  
M Sug Teaspoonful after  
each meal

5-6 74 Grier

descending secondary currents of Electro-Magnetism to lower limbs—nose to the upper breast muscle separately. For the brain—Inverse constant current say about 6 to 10 Daniells cells from each sciatic N. & sacro-lumbar region, not any higher under any circumstances. Every other day.

Dr. Longaker is still living in Philadelphia. In personal letter to the author Dr. Longaker reminisces about Walt, but illness but cannot recall any details not already recorded in his article, "The Last Sickness and Death of Walt Whitman" (4).

Dr. Longaker showed Walt how to catheterize himself with soft rubber catheter. He expressed surprise that the operation was so easy and painless. No arguing or coaxing was required, as is almost always necessary when this procedure is instituted" (4).

**Ears** Except for occasional episodes of deafness associated with severe colds, hearing was good.

**Nose, pharynx, tonsils** Frequent colds and sore throats see Past History.

**Mouth** Negative.

**Teeth** No record of his ever having visited a dentist.

**Heart** Negative.

**Lungs** During the years 1863 to 1865 while nursing the sick and wounded in Washington, Walt was constantly exposed to "lung diseases" (19). In April 1860, he had a severe attack of the grip which "sometimes almost strangled me" (3). In March 1891 he had some slight trouble in his upper respiratory tract which he called his "old attack of grip" (4). At no time did he complain of cough, dyspnea, wheezing, hemoptysis or chest pain.

**Abdomen.** See Present Illness.

**Gastrointestinal.** In December 1873 at the age of 54, Walt complained of "head troubles, & stomach troubles, & liver troubles—the doctor thinks the latter the seat & basis this time of all, or nearly all—head swimming, faintness, vomiting &c." (14). On May 22 1874, "my being disabled and want of exercise for 16 months, (and many other wants too) have saddled me with serious dyspepsia and what the doctor calls gastric catarrh, very obstinate causing me really more suffering and pain than my paralysis." In December 1875 "these troubles" (feeling of death and dizziness) "in the doctor's opinion 'are from a very serious and obstinate liver affection—not from head, lungs, heart'" (13). March, 1876 "I still have this baffling obstinate, apparently chronic affection of the stomachic apparatus and liver appetite sufficiently good, eat only very plain food digestion tolerable." (2) Jan. 21, 1891 "head, belly and bladder matters all in a bad way" March 16 1891 "Obstinate long-continued horrible indigestion." (3) May 23 1891 "The fiendish indigestion block continued" (14). Walt complained of obstinate constipation until onset of present illness. There is no mention of jaundice, characteristic gall-bladder pain or intolerance to fatty foods.

**Genitourinary.** Dec. 3, 1888 "My physical trouble has veer'd quite entirely lately, or (more truly) added to and is now that senile botheration from prostate or enlarged or inflamed gland (bladder business, diabetes) or other worse or less form of ailment. Dr. Osler was here this afternoon and is to bring over a surgeon on the 5th P.M., for more concise examination." It has resulted the last four nights in quite no sleep.

Dec. 4 "The gland suffering or whatever it is (the distressing recurrent stricture like spasms, about from three to ten minutes almost continuously the last five days and nights) has let up." (3) Jan. 21, 91 "head, belly and bladder matters all in a bad way" Mar. 91 Frequency 20 times a day, nocturia, dysuria (See Past History).

**Venereal** Negative.

**Neuromuscular.** See Past History.

**Extremities.** See Past History.

**Personal habits.** In person Whitman was large and tall, above six feet. "He was in no sense a muscular man, an athlete. His body though superb was curiously the body of a child. One saw this in its form, in its pink color and in the delicate texture of the skin. He took little interest in feats of strength, or in athletic sports. He walked with a slow rolling gait indeed moved slowly in all ways he always had an air of infinite leisure" (1).

His usual weight was 200 pounds or more, but at the onset of the present illness was only 140 pounds. Although temperate in the use of alcohol, he was not a total abstainer. He was inclined to eat excessively. He did not use tobacco.

\*On his next visit Osler brought with him Dr. Wharton there is no record of their joint opinion on the case (11).



Fig. 4. Whitman with his nurse Warren Fritsinger in July 1890.

#### Present Illness (4, 6)

Walt was in his usual health until the afternoon of December 17 1891 when he had a severe shaking chill followed by a rise in temperature (102°). This was accompanied by slight hoarseness and a cough productive of mucopurulent sputum. There was complete loss of appetite and marked prostration.

**Course of illness.** Dr. Longaker saw the patient 24 hours after the onset of the illness. At that time he found areas of dullness over both lungs, particularly on the right. The following day the third of his illness, the areas of dullness had increased, especially over the right lung. It was thought he had a widely diffused bronchopneumonia. The lungs were poorly aerated and there were "hints of heart failure." On the fourth day Dr. Alexander McAlister of Camden was called in consultation so that a doctor could be immediately available in case of a sudden change for the worse. Walt showed no improvement and a tracheal rattle and cyanosis were noted. On December 22nd irregularity of the pulse developed. The following day the irregularity was more marked. Somnolence and cyanosis continued. Dec. 24 Extensive involvement of the left lung was found with the right practically useless. There was marked cyanosis, labored respirations, and a rapid weak, and irregular pulse. Dec. 26 Walt appeared semi-conscious but could be roused easily. The heart was still



breathing purposes. The upper and middle lobes were consolidated and firmly bound down to the pleura. There were about four ounces of fluid in the cavity. Large tubercular nodules and areas of catarrhal pneumonia were everywhere to be found. Those portions of the lung not tubercular were markedly emphysematous, this being especially marked at the free edges of the lung.

The spleen was soft and weighed about eight ounces, the capsule thickened and fibrous on section pulpy. It was matted down to the diaphragm and showed only peritonitis and peri-splenitis. Numerous tubercles occupied this region extending to the anterior wall of the stomach and to all of the neighboring viscera. The diaphragm was pushed downward by the fluid.

The kidneys were surrounded by a mass of fat. The left suprarenal capsule was tubercular and contained a cyst the size of a pigeon's egg. In this was found a darkish fluid. The capsule strips readily; the kidney weighed about six and one half ounces, and showed some parenchymatous change. The kidney substances were soft, red, and swollen and somewhat granular. The right kidney was a little the smaller and the better of the two.

The liver was about normal in size, though fatty and contained an extra fissure near the center. Some tubercles were observed.

A huge gall stone almost entirely occupied a rather small gall bladder to which it was firmly adherent. The outer surface of the stone was covered with a whitish deposit.

The pancreas was hemorrhagic. The common ducts were but very slightly atheromatous.

Over the whole of the mesentery especially in its lower portion were hundreds of minute tubercles varying in size from that of a fine needle-point to the head of a good sized pin. These whitish points were surrounded by a hemorrhagic base. The serous surface of the intestines was injected and dotted with tubercles. The bladder was empty and the walls thickened. The prostate was enlarged. The rectum was swollen and filled with semi fluid feces. A few hardened masses were found in the transverse colon. The stomach was small. The vermiform appendix was two inches long and patulous, containing two small hardened fecal masses of an irregular outline. The sigmoid flexure was unusually long.

The above macroscopic lesions of the various organs were confirmed by microscopic sections.

It would seem very probable that the extensive adhesion of the dura mater to the calvarium was due to an old sun-stroke.

"The cause of death was pleurisy of the left side, consumption of the right lung, general miliary tuberculous and parenchymatous nephritis. There was also found a fatty liver gallstone a cyst in the adrenal, tubercular abscesses, involving the bones, and pachymeningitis."

#### COMMENT

The autopsy is exasperatingly incomplete and from the available facts it is difficult to reconstruct the exact sequence of events which led to Walt's death. However it is sufficiently inclusive to allow us to revise the diagnosis to conform with our present-day concepts of pathology.

Did Whitman really have tuberculosis? Could he have had cancer of the prostate with terminal spread or a primary cancer of the lung? Tuberculosis was well recognized by 1892<sup>14</sup> however and

<sup>14</sup>Koch work on the tubercle bacillus was done in 1882.



Figure 5 Whitman at 72 1891

since the autopsy was performed by some of the best American pathologists of the day we are reasonably safe in accepting their diagnosis.

Judging from the extensive involvement of the right lung the upper and middle lobes were consolidated and firmly bound to the pleura. The tuberculous process was of long duration probably years. Unfortunately no mention is made of the left lung other than that it was completely pressed against the mediastinum. The apparent long duration of the pulmonary lesion with no antecedent history of cough dyspnea, chest pain or hemoptysis is nothing short of remarkable. Walt was exposed to members of the family with tuberculosis for several years before he left for Washington in 1862 at the age of 43 but it was precisely at this time that he was proclaiming his excellent health. During his Washington hospital days also he must have been exposed to much tuberculosis among the soldiers. However in his frequent references to his illnesses of this period there is no mention of pulmonary compli-

cations. The tuberculous pleural effusion on the left probably had been present some months before his terminal illness and could have been secondary to extension through the parietal pleura of the chest wall abscess or the rupture of a small tuberculous node.

At the onset of his last illness the infected pleural fluid, which could have been responsible for the sudden chill and fever, must have ruptured into a bronchus, for there was profuse expectoration of mucopurulent sputum at the onset, something entirely new for Walt. This profuse expectoration which was greatly accentuated when he lay on his right side persisted until his death. Sufficient drainage of the left chest through the bronchus must have occurred to produce the slight symptomatic improvement noted early in the course of his last illness. The fluid on the left was not diagnosed antemortem because the doctors did not wish to subject Walt to the discomfort of a complete examination. The presence of a bronchopleural communication on the left is further borne out by Dr. Longaker's examination of the anterior surface of the chest on March 11th when he found "impairment of resonance on right—good on left, indicating that there was air in the left pleural space and not in the lung, since the autopsy showed the lung to be collapsed against the mediastinum.

The tuberculous abscesses of the sternum, rib and chest wall and foot were old but their exact duration is difficult to estimate.

Numerous tubercles occupied the area around the spleen extending to the anterior wall of the stomach and all neighboring viscera including the left adrenal gland. No tubercles were found in the splenic pulp and only a few were observed in the liver. The mesentery and intestine particularly the lower portion were covered with minute tubercles. This certainly is not the picture of a military spread via the blood stream but rather that of a direct dissemination probably from an old focus around the spleen a lesion which may have been of the same vintage as the abscesses described above and which undoubtedly accounted for the hiccough and severe pain in his left side.

The left adrenal cyst indicated an old process and may have been in part responsible for the "lassitude and inertia" Walt complained of for many years. No mention was made of the right adrenal gland.

Since careful examination of the brain was not carried out we have no record of old areas of destruction which might have been present, but we do have the autopsy findings of extensive

cerebral atrophy. In spite of marked wasting of the brain described at the postmortem examination, Walt's mind continued active and keen to the last<sup>14</sup> although his memory had begun to fail.

His long-standing symptoms of indigestion, nausea and constipation can be attributed to the chronic cholecystitis and cholelithiasis.

His urinary symptoms arose from the urethral obstruction secondary to hypertrophy of the prostate.

Did Walt have hypertension or perhaps a labile blood pressure secondary to vasospasm? This, of course, would have been an antemortem diagnosis if his blood pressure could have been measured.<sup>15</sup> In favor of such a condition are his ruddy complexion, frequent severe headaches and feeling of fullness in the head and the numerous slight to severe cerebral insults suffered after 1858. However in hypertension of such long standing we should expect more advanced arteriosclerosis and cardiac hypertrophy.

Our revised and final diagnosis should read, then: Pulmonary tuberculosis far advanced, right atelectasis of left lung, tuberculous empyema, left bronchopleural fistula, left disseminated abdominal tuberculosis, tuberculous abscesses of sternum fifth rib and left foot, cyst of left adrenal gland, chronic cholecystitis and cholelithiasis, cerebral atrophy, cerebral arteriosclerosis, benign prostatic hypertrophy, pulmonary emphysema, cloudy swelling of kidneys, history of hypertension (?).

In an age of psychiatry no discussion of Whitman's medical history would be complete without some mention of that very controversial subject of his sexuality. Was he homosexual? At this late date an unassailable answer is unlikely although after a study of his life, personality habits, and writings, one fact stands out clearly by no standards could Whitman's attitudes and behavior toward sex be considered "normal." Yet the change of homosexuality has never been proved. John Burroughs, a friend of long standing described Walt as in "no sense a muscular man an athlete. His body though superb, was curiously the body of a child. One saw this in its form, in its pink color and in the delicate texture of the skin." (1) Perhaps this is the real clue to the personality of the man who embraced all mankind, man and woman alike. Could he have been eunuchoid?

<sup>14</sup>Last revision of *Leaves*, 80-92.

<sup>15</sup>Sphygmomanometry was introduced in the late 19th century.

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## REVIEWS OF NEW BOOKS

IN the opening chapter of *Erkrankungen des uropoetischen Systems und der Prostata durch Störung der Blutströmung* by Hutter the author favors humoral pathology of living tissues over the cellular pathology teaching of Virchow. In his opinion humoral pathology gives a more rational explanation of normal and abnormal body cells. Increase and growth of tissues result from substances brought to it by the blood stream. In malignancies for instance there is a battle between the blood ingredients going to normal and tumor cells. Many writers are quoted endorsing the new views of disease and pathological cellular changes. Hutter contends that laboratory examinations and procedures while important, can never give an accurate clinical estimate of the patient's health and prognosis.

In prostatic hypertrophy the author states that there is a hormonal imbalance with the male component predominating. Following surgery of the prostate Hutter believes that foreign hemostatic bodies and ligatures used to control bleeding promote wound infection and secondary hemorrhage. The wound reunion of the urethra and bladder with primary bladder closure tends to shorten the morbidity and wound healing. The prostatic bed can produce its own hemostasis and should not be interfered with too much by the surgeon.

Urinary calculi were more frequently noted in immobilized injured and wounded soldiers. Many autopsies and reports are quoted giving the incidence of urinary calculi in amputees and severely wounded. There was a much higher mortality in soldiers following nephrectomy for tuberculosis (25%) than in peacetime civilian practice (no deaths in 200 nephrectomies). The high mortality is attributed to war dislocations and shock.

The circulation in the presence of renal lesions (pyelonephritis, early arteriosclerosis, war nephritis, poisons) may be improved by removing the overacting vasoconstrictors (decapsulation).

The lesser grades of nephropoiesis seldom cause hydronephrosis and infection. Mild cases should be treated conservatively. Advanced cases respond to surgery and nephropexy.

There is an interesting discussion on scoliosis, kyphoscoliosis, lordosis, and resulting impairment of renal function. The difference in renal and ureteral displacements on the convex and concave sides are carefully noted and illustrated with drawings and roentgenograms.

This compend is a good postwar review of urologic subjects and problems. Infectious urology is not in-

cluded. There is no mention of the newer therapeutic agents as penicillin or streptomycin.

LEANDER W. RITA

THE first edition of *Fundamentals of Psychiatry* by Edward A. Strecker appeared in 1942. In the fourth edition the text has been revised once again. The author has added a chapter on psychosomatic psychiatry as well as two suggested nomenclatures for classification. There are chapters also on etiology, methods of examination and symptoms organic and toxic psychoses, functional psychoses and psychoneuroses, psychiatry and war and psychiatric nursing, and finally there is a glossary and an index. The style is clear, terse, firm and often distinguished by dry wit. Diagrams are offered to represent the author's conceptions for elementary students. His extensive experience is often evidenced and his grasp of the somatic aspects and accompaniments of mental disease. His general approach agrees with that of Adolph Meyer well known as psychobiology (d.p. 34). The name of Freud appears only twice when he speaks of Freud's "hypothesis of the Id" (p. 172) and of Freud's conception of neurasthenia (p. 238). However the influence of Freud can be traced on numerous pages when the author gives his own views, for example on conversion hysteria and on paranoia and paranoid conditions. "In waking life and in sleep," he states (p. 106) "in its conscious, subconscious and unconscious components there is unceasing mental activity. Like some other topics, treatment as a rule is little more than outlined in this book. Nevertheless, the beginner in psychiatry and the doctor in other fields will find it most useful in acquainting him with the status of present day psychiatry." EDMUND JACOBSON

THE great decline in the incidence and mortality from communicable disease in the United States during the past twenty five years and the introduction of chemotherapy and antibiotic therapy has reduced the number of specialists skilled in the diagnosis and treatment of communicable diseases. In most instances these experts are principally found in cities of great population where the greatest number of cases occur. However, diagnosis, adequate modern treatment, and reporting of cases promptly to health authorities to increase speedy control are still a major responsibility of the general practitioner.

The need for authoritative reference based on up-to-date experience is now more essential than ever for the complete battle against the communicable diseases.

*ERKRANKUNGEN DES UROPOETISCHEN SYSTEMS UND DER PROSTATA DURCH STÖRUNG DER BLUTSTRÖMUNG.* By Professor Dr. Karl Hutter. Vienna, Austria: Wilhelms Mandrich, 1947.

*FUNDAMENTALS OF PSYCHIATRY.* By Edward A. Strecker, M.D., Sc.D., M.D. Litt.D., F.A.C.P. 4th rev. ed. Philadelphia, London, and Montreal: J. B. Lippincott Co., 1947.

The second edition of *Handbook of Communicable Diseases* by Dr. Franklin H. Top presents in a clear, concise, colorful and illustrative pattern the present day knowledge about each communicable disease which the family physician is called upon for consultation.

The 14 new chapters dealing with specific diseases and discussed by collaborating authorities enrich the value of the second edition of *Handbook of Communicable Diseases*. Newer problems such as primary atypical pneumonia, revision of nursing care leprosy, management of communicable diseases in hospital, malaria, epidemic keratoconjunctivitis, leptospiral jaundice, ringworm of the scalp constitute additional information elaborated upon in the second edition.

This book deserves not only the intensive study of every medical student but also should be part of the personal library of every general practitioner.

E. A. PRZECZEK

A SERVICEABLE aid to the medical student and a convenient source of graphic material for the postgraduate is presented in Professor Jamieson's *Illustrations of Regional Anatomy*. The seven small volumes contain an ample series of pictures of gross anatomical structures. The booklets however have no accompanying text, contain no directions designed to guide a dissector. The legends are of the briefest order. The current edition and its predecessor contain an index.

The illustrations are grouped in compact volumes in each of which the loose leaves are fitted on pillars from these the sheets are easily removable for rearrangement in any sequence momentarily convenient to the reader. The pages are printed on one side only the paper stock is unusually good. The 320 plates of illustrations cover the anatomy of the several subdivisions of the body: central nervous system, head and neck, abdomen, pelvis, thorax, upper limb and lower limb. The head and neck are allotted the largest number of figures, the thorax the smallest number.

The brain is extensively illustrated, basal nuclei, motor and sensory areas are indicated diagrammatically, as are also the principal tracts, commissures, etc., blood vessels, cerebral ventricles and choroid plexuses are all presented in very arresting coloration.

The anatomical features of the head and neck are illustrated by drawings which include entire dissection fields, layer by layer dissections of individual sense organs, diagrams of nerve plexuses and of transverse and sagittal sections taken at crucial levels. Some of the figures might be baffling to a

novice since they do not indicate what has been excluded or which layers have been removed to bring into view the stratum which the figure represents. Others lose value by being so diagrammatic that they merely suggest but do not closely resemble the particular group of structures as they appear in a dissected human body.

The booklet on the abdomen contains ingenious illustrations of the abdominal muscles and the inguinal canal, but some of them in being utterly diagrammatic, sacrifice anatomical clarity to attain schematic vividness. The treatment of the inguinal region, mesenteries, blood vessels, kidneys and suprarenals is highly conventional, the figures resemble museum models rather than dissections. The schematic drawings of the abdominal layers take considerable liberty with the true constitution of the parietal lamellae and laminae; they do record the common variations which are important in laparotomy and in hernioplasty.

In the volume on the pelvis and perineum, color is again profusely but often helpfully used. The author's order of plates is seemingly rather haphazard for a division of anatomy in which a knowledge of serial succession is of fundamental surgical importance. While the layers of the pelvic and urogenital diaphragms are shown in schematic clearness, they are not portrayed accurately. The relations of the pelvic viscera to their ligamentous, fascial and diaphragmatic supports would be of little use in training critical students for the practice of gynecology, urology or proctology.

In the set of plates which depict the anatomy of the thorax, the schematic method is utilized to great advantage, since much of the important anatomy of the thoracic cage and of its visceral, vascular and nervous contents may be taught from transverse and sagittal sections and from surface projections of organs.

In the sections on the upper and lower extremities the figures which show the plaques of muscular attachment to the skeletal elements are fundamentally similar to those found in the standard textbooks, atlases and manuals of gross anatomy. Here the order is the logical one of successive layers from cutaneous nerves, superficial veins, and fascial sleeves through progressively deeper layers of muscle. In the simpler figures for example those dealing with the synovial sheaths of the hand and foot the schematic plan is utilized to great advantage but when the same device is employed to show the tendons, nerves, vessels and muscles, the collection of transected structures forms a somewhat overpowering assemblage.

The colors employed in the illustrations seem upon first examination to be needlessly garish. However the reader soon becomes accustomed to their chromatic strength and learns to use the colors as so many signals.

Considered as a whole *Illustrations of Regional Anatomy* is a useful adjunct to the student's regular anatomical library. It treats of the kind of anatomy

*HANDBOOK OF COMMUNICABLE DISEASES.* Franklin H. Top, A.B., M.D., M.P.H., F.A.C.P. 2nd ed. St. Louis: The C. V. Mosby Co., 1947.

*ILLUSTRATIONS OF REGIONAL ANATOMY.* By E. B. Jamieson, M.D. Section I—Central Nervous System, Section II—Head and Neck, Section III—Abdomen, Section IV—Pelvis, Section V—Thorax, Section VI—Upper Limb, Section VII—Lower Limb. 7th ed. Edinburgh: E. & J. S. Livingstone, 1947. Baltimore: The Williams & Wilkins Co., 1947.

which is customarily presented in charts. Its graphic character, going beyond the limit set in the standard type of illustration allows the set of books to function as a link between the regular atlas which the student uses at the dissection table and the black board drawings which so commonly enliven lectures in gross anatomy. For the familiar compends, digests and summarizing handbooks of anatomy these abundantly illustrated volumes would serve as ideal companions.

BERRY ANSON

THE ninth revision of the popular textbook, the *Ballenger D. cases of the Nose, Throat and Ear* remains one of the best introductions to otolaryngology for the student and practitioner. It is easily read and clearly written for the most part and its numerous illustrations are well selected and graphic. A wide amount of information is given which in the

10th ed. of the *Nose, Throat and Ear*. By William Lincoln Ballenger M.D. F.A.C.S. and Howard Charles Ballenger M.D. F.A.C.S. Assisted by John Jacob Ballenger B.S. M.D. 9th ed. Philadelphia Lea & Febiger 1917

space allotted requires a somewhat dogmatic presentation. Moot points are on the whole adequately discussed and errors are few.

Considerable emphasis has been placed on operative procedures. While this may give the student a somewhat biased view it helps make the book valuable for reference as well as for an undergraduate text. From description and illustration, operative techniques are easily grasped. The method of describing operative procedures on the basis of historical development gives the student an understanding not otherwise attainable in many instances. In others it leads to the retention of perhaps an unnecessary amount of deadwood.

Latest advances in the specialty are well covered. A new chapter has been added on headaches and neuralgias of the face and head and up to date revisions are given on the labyrinth endoscopy and the operative relief of laryngeal paralysis by authorites in those fields. The format is good the paper and printing excellent and the volume maintains its previous high standing.

T. C. GALLOWAY

## BOOKS RECEIVED

Books received acknowledged in this department and such acknowledgment must be regarded as sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers and as space permits.

THE 917th BOOK OF NEUROLOGY PSYCHIATRY AND NEUROSURGERY NEUROLOGY edited by Han H. Reese, M.D. and Mabel C. Masten M.D. PSYCHIATRY edited by Noland D. C. Lewis, M.D. NEUROSURGERY edited by Percival Bailey M.D. Chicago The Year Book Publishers, Inc., 1948.

HUMAN PHYSIOLOGY By F. R. Winton, M.D. D.Sc. and L. E. Bayham, M.D. 3rd ed. Philadelphia, Toronto The Blakiston Co. 1948.

PHYSICAL THERAPY OF INJURIES OF THE BRACHIAL AND ALIEN NERVOUS DISORDERS. By K. M. Hern. With Foreword by Air Vice-Marshal G. Charles P. Symonds, K.B.E., C.B. D.M. F.R.C.P. Baltimore The Williams & Wilkins Co., 1947.

THE DIGESTIVE TRACT: ROENTGENOLOGY. By Jacob Bockstein M.D. Philadelphia, London Montreal J. B. Lippincott Co., 1948.

THE HOSPITAL CARE OF NEUROSURGICAL PATIENTS. 2nd ed. By Wallace B. Hamby M.D. F.A.C.S. Springfield Ill. Charles C. Thomas, 1948.

NEUROANATOMY By Fred A. Mettler A.M., M.D. Ph.D. 2nd ed. St. Louis The C. V. Mosby Co. 1948.

A TEXT BOOK OF GYNAECOLOGY FOR STUDENTS AND PRACTITIONERS. H. James Young, D.S.O., M.D. F.R.C.S.E., F.R.C.O.G. 7th ed. New York The Macmillan Co. 1948.

IDENTIFICATION OF TUMORS. Essential Gross and Microscopic Pathologic Features Systematically Arranged for Easier Identification. By N. Chandler Foot, M.D. Philadelphia, London Montreal J. B. Lippincott Co., 1948.

SURGICAL APPLIED ANATOMY. By Sir Frederick Treves, Bart. 11th ed. revised by Laurett Rogers, M.Sc. F.R.C.S., F.R.C.S.E., F.R.A.C.S. F.A.C.S. Philadelphia Lea & Febiger 1947.

MODERN MEDICINE ANNUAL. An annual volume containing the articles which appeared in Modern Medicine during 1947. Minneapolis, Minn. Modern Medicine 1948.

CORONARY HEART DISEASE. By A. Carlton Ernest, M.D. Springfield, Ill. Charles C. Thomas, 1948.

PHYSIOLOGICAL THERAPY IN RESPIRATORY DISEASE. By Alvan L. Barach, M.D. 2nd ed. Philadelphia, London Montreal J. B. Lippincott Co. 1948.

LABRE BRONCHIQUE; ETUDE ANATOMIQUE, HISTOLOGIQUE ET THÉRAPEUTIQUE. By Dr. Henri Métral. With the collaboration of J. Meulnier. Paris Vigot Frères, Editeurs, 1948.

A TEXTBOOK OF GYNAECOLOGICAL SURGERY. By Kate Boeney M.S. M.D., B.Sc. (Lond.), F.R.C.S. (Engl.) Hon. F.R.A.C.S., Hon. F.R.C.O.G., M.R.C.P. (Lond.) 5th ed. New York Paul B. Hoeber Inc. 1948.

# CLINICAL CONGRESS OF AMERICAN COLLEGE OF SURGEONS

ARTHUR W ALLEN Boston *President*  
DALLAS B PHEMISTER, Chicago, *President Elect*

## PRELIMINARY PROGRAM FOR 1948 CLINICAL CONGRESS THE BILTMORE HOTEL, LOS ANGELES, OCTOBER 18 TO 22, 1948

**P**LANS are proceeding for the program of the thirty fourth Clinical Congress of the American College of Surgeons which will be held in Los Angeles at the Biltmore Hotel from October 18 to 22 1948

A preliminary schedule of clinics, preceded by a list of the hospitals which will participate and the names of the representatives who are responsible for the program at each hospital, was published in the June issue. Twenty-five hospitals have so far indicated a desire to participate and they will arrange their programs to cover subjects in general surgery obstetrics and gynecology fractures, or thopedic surgery thoracic surgery neurosurgery genitourinary surgery and ophthalmology and otorhinolaryngology During the Congress Daily Clinical Bulletins will be issued which will give the final clinical program

It is expected that arrangements for telecasting operations from one or more of the hospitals will soon be ready for announcement. The use of television is especially desirable after the exceedingly successful demonstration of its teaching value at the Clinical Congress in New York last year

The usual varied and comprehensive program of meetings at the headquarters hotel is planned. The opening session will be a General Assembly for both surgeons and hospital personnel on Monday morning Scientific sessions, official meetings, and hospital conferences will follow during the five day Congress. In addition to meeting rooms in the Biltmore Hotel the Biltmore Theater and the spacious Philharmonic Auditorium across the street from the hotel will be used for the larger audiences The capacity of the Philharmonic Auditorium is 2,700 and that of the Biltmore Theater about 1,700

### PRESIDENTIAL MEETING

The opening evening session of the Clinical Congress will be devoted to the Presidential Meeting at which the officers-elect, consisting of Dr Dallas B Phemister of Chicago as president, Dr Howard A Patterson of New York as first vice president, and Dr Carl H McCaskey of Indianapolis as second vice president will be installed. Dr Arthur W Allen of Boston, outgoing president and vice chairman of the Board of Regents, will preside and will deliver the Presidential Address. The third Martin Memorial Lecture will be delivered by Dr Clarence Crafoord Professor of Surgery University of Stockholm.

### CONVOCATION

The annual Convocation will be held on the final evening Friday The formal initiation ceremonies and the presentation of the Fellowship Address by Dr L A Du Bridge, President California Institute of Technology Pasadena, will constitute the program Dr Du Bridge's subject will be 'The Physicist Meets the Doctor'

### EVENING SCIENTIFIC SESSIONS—GENERAL SURGERY

'Malignant Lesions of the Thyroid Gland' will be the subject of the Tuesday evening general surgery symposium 'Pathology' will be discussed by Dr Frank W Foote of New York 'Aberrant Thyroid' by Dr Brien T King of Seattle 'Malignancy in Nodular Goiter' by Dr Warren H Cole of Chicago and 'Radioactive Iodine in the Treatment of Thyroid Diseases Including Cancer' by Dr Myron Prinzmetal Los Angeles

Endometriosis will be the subject for the Wednesday evening general surgery symposium. Significance of Endometriosis will be discussed

by Dr Joe V Meigs of Boston "Surgical Procedures Involved in the Treatment of Endometriosis" by Dr Virgil S. Counsellor of Rochester Minnesota. A third paper will be presented on "Theories and Medical Treatment of Endometriosis. The annual Fracture Oration will also be presented at the Wednesday evening session.

Surgery of the Heart and Great Vessels will be the subject of the Thursday evening general surgery symposium. "Surgical Treatment of Pulmonic Stenosis" will be discussed by Dr Alfred Blalock of Baltimore "The Surgical Treatment of Constrictive Pericarditis" by Dr Emile F Holman of San Francisco "The Surgery of Patent Ductus Arteriosus" by Dr John C. Jones of Los Angeles and "Treatment of Coarctation of the Aorta" by Dr Robert E Gross, Boston.

#### EVENING SCIENTIFIC SESSIONS—OPHTHALMOLOGY

The preliminary program for the Tuesday evening Ophthalmology session includes the following subjects "Tumors of the Eyelids and the Conjunctiva" by Dr Michael J Hogan of San Francisco "Partial Keratectomy" by Dr George L. Kilgore of San Diego and the third paper will probably be on "Studies of the Cytology of Conjunctival Exudates."

The Wednesday evening program will be devoted to a panel discussion on the subject, "Neoplasms of the Orbit and Nasal Accessory Sinuses and will be participated in jointly by ophthalmologists and otorhinolaryngologists.

The program for the Thursday evening Ophthalmology session includes the following subjects "Retinal Detachment," by Dr Dohrmann K. Pischel of San Francisco "The Use of Retrobulbar Alcohol Injection for Ocular Pain," by Dr Alfred E. Maumenee of Baltimore and the third paper is not yet definitely selected.

#### EVENING SCIENTIFIC SESSIONS OTORHINOLARYNGOLOGY

The preliminary program for the Tuesday evening Otorhinolaryngology session includes four subjects "Effects of Streptomycin on Eighth Nerve Function" by Dr Page Northington of Oakland "Anatomical Considerations in Ear Surgery" by Dr J. Brown Farrior of Tampa. A third paper will be on "Suspension Laryngoscopy" and there will be a fourth for which a definite title has not yet been determined.

The Wednesday evening program as stated under "Ophthalmology" will be on the subject, "Neoplasms of the Orbit and Nasal Accessory Sinuses," and will be a joint session with the ophthalmologists.

The program for the Thursday evening Otorhinolaryngology session includes the following four subjects "Tumors of the Nasopharynx," by Dr Harry C. Rosenberger of Cleveland "Modern Management of Oro-Antral Fistula," by Dr Richard Thomas Barton of Beverly Hills "Present Day Status of Fenestration Surgery" by Dr Leighton F. Johnson of Boston and a fourth paper will probably be on "Laryngeal Malnecy."

#### GENERAL SURGERY PANEL DISCUSSIONS

General surgery panel discussions will be held on Monday Tuesday and Wednesday afternoons, from 1:30 to 3:00 and from 3:30 to 5:00 o'clock, and on Thursday afternoon from 3:30 to 5:00. The early session on Monday will be on "Acute Renal Failure in Surgical Patients," with Dr Frederick A. Collier of Ann Arbor as moderator and the late session on "Tumors of the Mouth, Jaw and Face," with Dr Gordon B. New of Rochester Minnesota, as the moderator. The early session on Tuesday will be on "Low Lying Malignant Lesions of the Bowel," with Dr. Fred W. Rankin of Lexington, Kentucky as moderator and the late session on "Evaluation of Liver Function in Relation to Surgery" with Dr Nathan A. Womack, Iowa City as moderator. The early session on Wednesday will be on "Peripheral Arterial Disease" with Dr Alton Ochsner of New Orleans as moderator and at the late session "Ulcerative Colitis" will be discussed with Dr Henry W. Cave of New York as moderator. The Thursday session will be concerning "Isotopes in Surgery" with Dr George M. Curtis of Columbus as moderator.

#### OPHTHALMOLOGY PANEL DISCUSSIONS

Panel discussions in ophthalmology will be held Tuesday Wednesday and Thursday mornings from 9:00 to 10:30 o'clock. The Tuesday subject will be "Surgical Management of (1) Acute Inflammatory Glaucoma (2) Chronic Simple Glaucoma (3) Congenital Glaucoma," with Dr A. Ray Irvine of Los Angeles as the moderator. The Wednesday subject will be "Congenital Cataract" with Dr Otto Barkan of San Francisco as moderator. The Thursday subject will be "Surgery of the Oblique Muscles" and Dr C. Allen Dickey of San Francisco will act as the moderator.

#### OTORHINOLARYNGOLOGY PANEL DISCUSSIONS

Panel discussions in otorhinolaryngology will be held Tuesday Wednesday and Thursday mornings from 10:45 to 12:15 o'clock. The Tuesday

subject will be 'Rehabilitation of the Hard of Hearing' with Dr. Walter P. Work of San Francisco as moderator. The Wednesday subject will be 'The Preparation of the Surgical Patient and Postoperative Care' with Dr. Colby Hall of Los Angeles as moderator. The Thursday subject for discussion will be 'Diseases of the Esophagus' with Dr. Alden H. Miller of Los Angeles as moderator.

#### SPECIALTY PANEL DISCUSSIONS

Specialty panel discussions will be held on Friday afternoon from 1:30 to 3:00 and from 3:15 to 4:45 o'clock, as follows:

*Urology*—Moderator, Dr. Reed M. Nesbit, Ann Arbor

1:30 to 3:00 p.m.—'The Clinical Management of Branched Renal Calculi.'

3:15 to 4:45 p.m.—'Present Day Management of Urinary Tract Infections.'

*Orthopedic Surgery*—Moderator, Dr. John C. Wilson, Los Angeles

1:30 to 3:00 p.m.—'Mechanical Derangements of the Knee Joint.'

3:15 to 4:45 p.m.—'Fractures about the Hip.'

*Thoracic Surgery*—Moderator, Dr. Frank S. Dolley, Los Angeles

1:30 to 3:00 p.m.—'Diagnosis and Surgical Treatment by Pulmonary Resection for Carcinoma, Bronchiectasis, and Tuberculosis.'

3:15 to 4:45 p.m.—'Surgery of the Esophagus.'

*Plastic Surgery*—Moderator, Dr. Truman G. Blocker, Jr., Galveston

1:30 to 3:00 p.m.—'Congenital Facial Deformities.'

3:15 to 4:45 p.m.—'Burn Contractures of the Extremities.'

*Gynecology and Obstetrics*—Moderator, Dr. John C. Burch, Nashville

1:30 to 3:00 p.m.—'Hysterectomy: Physiological Considerations—Indications.'

3:15 to 4:45 p.m.—'Hysterectomy: Technical Considerations—Complications.'

*Neurological Surgery*—Moderator, Dr. Howard C. Naffziger, San Francisco

1:30 to 4:45 p.m.—'Cerebral Angiography'

- Anatomical Interpretations of Angiography
- Characteristic Patterns of Angiography in Brain Tumors.
- Angiography of Circulatory Lesions and Their Treatment.'
- 'Technique and Materials.'

#### FORUM ON FUNDAMENTAL SURGICAL PROBLEMS

The Forum on Fundamental Surgical Problems, one of the most popular features of Clinical Congresses during the past few years, will be held on Tuesday through Friday mornings in two sections meeting concurrently. Brief reports of original clinical and experimental observations relating to the broad aspects of surgery and the surgical specialties will be presented under the general direction of Dr. Owen H. Wangensteen, chairman of the committee. Forum on Fundamental Surgical Problems.

#### HOSPITAL CONFERENCES

The opening meeting of the twenty-seventh Hospital Standardization Conference will constitute the first formal session of the Clinical Congress, and will be a General Assembly for both surgeons and hospital representatives. Dr. Arthur W. Allen of Boston, President of the College, will preside. The hospital conferences will continue on Monday afternoon with sessions following on Tuesday, Wednesday and Thursday mornings, afternoons and evenings.

Hospital trustees, administrators, heads of the various hospital departments and their personnel, nursing groups, and many other persons directly or indirectly concerned about hospital progress, are invited to participate in the discussions at the hospital conferences, at which leaders in the hospital field are the speakers and the moderators. The meetings will include formal sessions, panel discussions, round table conferences, symposia and forums.

A meeting which is always of great interest to hospital administrators and members of medical staffs in hospitals as well as to surgeons is the Symposium on Graduate Training in Surgery which is scheduled for Thursday afternoon after the Annual Meeting of Fellows.

#### COMMITTEE ON ARRANGEMENTS

The Committee on Arrangements for the Clinical Congress in Los Angeles has been well organized and is actively functioning. The membership follows:

##### General Committee

Donald G. Tollefson, M.D., F.A.C.S., *Chairman*  
 Hugh T. Jones, M.D., F.A.C.S., *Vice-Chairman*  
 Harold Lincoln Thompson, M.D., F.A.C.S., *Secretary-Treasurer*  
 Gilbert J. Thomas, M.D., F.A.C.S., *Regent of the College*  
 E. Vincent Askey, M.D., F.A.C.S.  
 Max W. Bay, M.D., F.A.C.S.  
 J. MacKenzie Brown, M.D., F.A.C.S.  
 Lawrence Chaffin, M.D., F.A.C.S.  
 A. Ray Irvine, M.D., F.A.C.S.

Maurice Kahn, M.D. F.A.C.S.  
 W. E. MacPherson, M.D.  
 B. O. Raulston, M.D.  
 Louis J. Regan, M.D.  
 Carl Kusche, M.D. F.A.C.S.  
 Stafford Warren, M.D.

#### Committee for the Southern California Chapter

Ray B. McCarty, M.D. F.A.C.S., Riverside  
 Meredith G. Beaver, M.D. F.A.C.S., Redlands  
 Clarence E. Rees, M.D. F.A.C.S., San Diego  
 Carl G. Johnson, M.D. F.A.C.S., Long Beach  
 James H. Salm, M.D. F.A.C.S., Santa Barbara

#### Hospital Committee

The members of the hospital committee are listed with the list of hospitals participating in the clinical program which preceded the preliminary schedule of hospital clinics in the June issue.

#### MEDICAL MOTION PICTURES

An appreciated feature of the Clinical Congress will again be the showing of medical motion pictures each day. The latest available pictures on surgery and related subjects will be presented. Special showings will be arranged of medical motion pictures in the fields of ophthalmology and otolaryngology. Both sound and silent films will be shown, all of which will have been approved by the Committee on Motion Pictures. Some of the newer medical motion pictures now under production will be shown.

#### TECHNICAL AND SCIENTIFIC EXHIBITIONS

The Technical and Scientific Exhibits will occupy the Ballroom foyer, the Renaissance Room, and the Galleries of the Biltmore Hotel, according to present plans. Leading manufacturers of surgical instruments, x-ray apparatus, sterilizers, operating room lights, ligatures, dressings, hospital apparatus and supplies of all kinds, and pharmaceuticals, and publishers of medical books will be represented.

#### ADVANCE REGISTRATION

Surgeons who wish to attend the Congress should register in advance. Under a new plan, advance registration will greatly expedite the procedure of registering.

No registration fee will be charged Fellows whose dues are paid to December 31, 1947. For endorsed Junior and Senior Candidates, the fee will be \$5.00. Non-Fellows who after individual consideration are permitted to register will pay a fee of \$10.00.

No registration fee will be required of initiates of the class of 1948.

#### HOTEL RESERVATIONS

It is desirable to make hotel reservations as early as possible because of the shortage of hotel rooms that prevails in Los Angeles as well as in other cities. In making these, communications should be addressed to the Los Angeles Convention and Visitors' Bureau, care of the Los Angeles Chamber of Commerce, stating that you will be attending the Clinical Congress of the American College of Surgeons. All hotel reservations for the Clinical Congress are to clear through this Bureau. No correspondence should be sent directly to the hotels. A form for reservations was enclosed in the letter recently sent to Fellows. Choice of hotels may be designated. The hotels in Los Angeles require a deposit in advance.

There follows the list of member hotels, Convention and Visitors' Bureau, Los Angeles Chamber of Commerce.

#### LOS ANGELES HOTELS

	Rates (as of May 5, 1948)	
	Double	Two
Alexandria, 210 West 5th St.	\$ 6.00 up	\$ 7.00 up
Ambassador		
3400 Wilshire Blvd.	\$ 6.00-17.00	\$ 11.00-17.00
Biltmore, 5 South Old & St.	\$ 7.50-2.00	\$ 7.50-12.00
Chancellor, 351 West 7th St.	\$ 4.50-6.00	\$ 4.50-6.00
Chapman Park		
3401 Wilshire Blvd.	\$ 6.00-7.00	\$ 7.00-8.00
Clark, 426 South Hill St.	\$ 4.50-5.00	\$ 5.50-6.00
Commodore		
1203 West 7th St.	\$ 3.00-3.50	\$ 4.00
Elmer, 35 South Hope St.	\$ 3.00	\$ 3.00
Figueras		
939 South Figueras St.	\$ 3.00-4.00	\$ 5.00
Gates, 6th and Figueras Sts.	\$ 3.50-6.00	\$ 3.50-6.00
Gaylord, 3335 Wilshire Blvd.	\$ 7.50 up	\$ 7.50 up
Hayward, 6th and Spring Sts.	\$ 5.00	\$ 5.50
Hollywood Drake		
6721 Hollywood Blvd.	\$ 3.50 up	\$ 4.50 up
Hollywood Hotel		
Hollywood 1 Highland	\$ 3.00-6.00	\$ 5.00-6.00
Hollywood Knickerbocker		
1014 Ivar St.	\$ 6.00 up	\$ 6.00
Hollywood Plaza		
637 No. Vine St.	\$ 4.00 up	\$ 4.50 up
Hollywood Roosevelt		
7000 Hollywood Blvd.	\$ 7.00 up	\$ 8.00 up
Kipling, 4077 West Third St.	\$ 5.00	\$ 5.50-4.00
Leukersheim, 30 West 7th St.	\$ 3.00-4.50	\$ 4.50-7.00
Mayan, 3040 West 8th St.	\$ 4.00-5.50	\$ 5.00-5.50
Mayfair, 256 West 7th St.	\$ 5.00 up	\$ 6.00-7.00
Natick, 28 West 1st St.		
Roslyn, 1 West 5th St.	\$ 1.00-8.00	\$ 1.50-9.00
San Carlos		
507 West 5th Street	\$ 4.50	\$ 6.00
Savoy		
6th St. and Grand Ave.	\$ 3.50-5.50	\$ 4.50-5.00
Town House		
639 Commonwealth Ave.	\$ 4.00	\$ 4.00

July, 1948

# SURGERY GYNECOLOGY AND OBSTETRICS

*Supplement*

## INTERNATIONAL ABSTRACTS OF SURGERY

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# INTERNATIONAL ABSTRACTS OF SURGERY

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## COLLECTIVE REVIEW

### THE CAUSES AND POSSIBLE REDUCTION OF OPERATIVE MORTALITY IN GERIATRIC SURGERY WITH AN ANALYSIS OF 100 CONSECUTIVE AUTOPSY RECORDS

LOUIS CARP M.D., F.A.C.S. New York New York

'Grow old along with me!  
The best is yet to be,  
The last of life for which the first was made.  
Rabbi Ben Ezra. Browning

WHEN Marcus Tullius Cicero (106-43 B.C.) wrote his delightful and philosophical *De Senectute*, he little dreamed that in the middle of the twentieth century the medical profession and help explain the aging process and that they would seek methods to increase longevity and to insure a happier and healthier existence during the declining years. With an inspiring optimism, Cicero relished the activities of old age. He indicated his intolerance of those who grumbled about advancing years when he quoted the venerable Cato as saying in his dialogue with his two younger disciples Scipio and Laelius "the very period (old age) which at a distance is every man's warmest wish to attain no sooner arrives than it is equally the object of his lamentations, and I know not than the learned leisure of a virtuous old age." He dismissed the sex problem by quoting the nonagenarian Sophocles who when asked if he engaged in amorous commerce with the fair sex exclaimed "Heaven forbid! and glad am I to have made my escape from the tyranny of so im-

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perious a passion. He was a firm believer in the immortality of the soul. Among the simple rules that he formulated for the prolongation and enjoyment of life were discretion in eating habits, mental activity, occupation on the soil and participation in sports. Some of these rules were erroneously arrived at by generalizing from the particular. Surgery was not mentioned. He left that for those who were to follow.

A previous communication (10) reports a statistical analysis of 2558 collected cases including our series. All of the patients were over the age of 60 and had had major operative procedures including emergency surgery. They showed a mortality rate of 13.1 per cent. Our own experience in a municipal hospital was based on 450 major surgical operations, 13 per cent of which were of an emergency nature. The over-all mortality was 22.6 per cent in patients who represented an extreme substandard risk. All of these figures are not prohibitive when we consider that the major portion of the patients were cared for in periods when the more recent advances in chemotherapy, diagnostic aids, early ambulation, anesthesia, nutrition and parenteral and vitamin therapy were not available. In our cases the clinical impression was given that the major causes of operative death within 1 month after operation were heart failure, bronchopneumonia or both accompanied by pulmonary edema. This impression was fortified by a review of 55 autopsy records of patients between the seventh and tenth decades. It is the purpose of



TABLE I—DEATHS FROM SPECIFIED CAUSES  
AGES 60 TO 74 YEARS METROPOLITAN LIFE  
INSURANCE COMPANY WEEKLY PREMIUM  
PAYING INDUSTRIAL BUSINESS FOR 1945

Cause of death	Number of deaths 60-	Per cent of 74
All causes—excluding enemy action	35.53	48.1
(Ten leading causes)	48,149	5.6
Organic heart disease	15,825	64.3
Cancer—11 forms	9,533	52.8
3 Diseases of the coronary arteries and gross pericarditis	6.36	56.0
4. Cerebral hemorrhage and pulmonary thrombotic cause	5.86	62.7
5. Accident—11 forms	7.0	9.3
6 Tuberculosis—11 forms	698	16.5
7 Chronic nephritis	3,360	56.4
8 Influenza and pneumonia	7	4.4
9 Diabetes mellitus	564	63.3
Cirrhosis of the liver	53	38.3

this article to discuss in more detail a larger number of our autopsy findings covering the period from 1930 to 1947 and they relate to the causes of operative mortality in genitric surgery and also to discuss briefly various possible salient prophylactic measures against such mortality. In making certain observations in this study it must be recognized that there are some variable and intangible factors in the condition of these patients in the light of which positive conclusions are difficult to establish.

#### LIFE SPAN AND MORTALITY RATE

The life span is increasing. Extraordinary progress has been made during the past 35 years in conserving life despite the adverse effects of two world wars and a major economic depression. The expectation of life at birth rose from 46.2 years in 1911 and 1912 to 65 years in 1945—a gain of 18.3 years (36). Between the ages of 65 and 74 the decrease in mortality from the years between 1911 and 1915 to those between 1941 and 1945 was 29.1 per cent for white males, 22.9 per cent for colored males, 36.7 per cent for white females, and 25.8 per cent for colored females. It is estimated (37) that those who are 65 years and older will constitute 9.1 per cent of the population in 1960 and 11.0 per cent in 1980. Table I (41) is self explanatory and demonstrates clearly that the leading causes of death are diseases which attack people of the older age groups. These observations present a challenge which the surgeon must meet by playing an increasingly important role in geriatrics.

#### OPERATIVE MORTALITY DEFINED

What constitutes an operative mortality? The answer to this question necessarily gives rise to varying opinions. Basically the time element involved in a death after operative therapy should be the important factor. Balanced against this is a life span without operation. It is not justifiable to speak of a mortality 3 months postoperative if it is estimated that the patient with diminished homeostases would have lived no longer nor less than 3 months without operation. For practical purposes, it has been our custom to speak of operative mortalities in the aged if they occur within 1 month after operation. Generally during this period the patient feels the maximum effect of a technical procedure and it is at this time that the surgeon uses his greatest effort to tide him over. He either wins or loses.

#### THE CAUSES OF OPERATIVE MORTALITY

It is fair to state that in our hospital, as in other hospitals, efficiency was diminished during the war years because of insufficient and, at times, inexperienced personnel to carry out routine procedures. The shortage of physicians, nurses, attendants, and laboratory workers caused curtailment in service and inadequate observation for the records. The increased and multiple demands on those on the home front necessarily resulted in less supervision by those in senior positions. It may be assumed these conditions had some bearing on adverse mortality rates during this period.

Systemic pathological changes in the aged are usually so varied and marked that unless there is an obvious cause of death it may be difficult even after autopsy to state the principal cause of operative death, i.e., the lesion which has killed the patient. Concomitant disease of the heart, blood vessels, kidneys, lung, liver or brain, with accompanying metabolic disturbance may confound the pathological picture to such an extent that it is almost impossible to attribute the cause of operative death to a specific pathological diagnosis. The problem is simplified if there is evidence of an acute myocardial infarction, cerebral hemorrhage, primary tuberculosis, severe bilateral pneumonitis, multiple liver abscesses, pancreatic necrosis, general peritonitis or carcinoma with multiple metastases. Too frequently autopsy protocols show a long list of pathological findings which the most expert pathologist may find difficult to evaluate in terms of the principal cause of death. Therefore after a mortality conference in which there is an exhibition of organs and tissue sections from autopsy material the clinician may be left in the dark concerning the principal cause of

death The contributing causes are usually more evident. One patient had a celiotomy in the course of which an inoperable carcinoma of the stomach was found. Two days later he died and autopsy also showed a diffuse bilateral bronchopneumonia. Did the carcinoma or the pneumonia kill him? In order to avoid academic discussion we have inclined to the belief that he would have lived longer without operation and that the bronchopneumonia was the primary cause of death.

A correlation of clinical impressions and autopsy findings in the older age groups has clearly demonstrated that death has too often resulted from unsuspected pathologic conditions which are in no way related to the condition for which the patient had surgical therapy. Chief among these are pneumonia, cardiac dilatation, gastric and intestinal dilatation, thrombosis, and infection in vital organs.

In order to minimize the possibilities of error in determining the cause of operative death because of the clinical findings, 100 consecutive autopsy protocols of patients above the age of 60 who died within 1 month after operation were analyzed. The results of the analysis have been striking and instructive. The contributing causes of death common to all the records were varying degrees of arteriosclerosis, valvular defects, coronary atherosclerosis and myocardial, renal, and liver damage. These contributing factors cannot be underestimated since any one of them or any combination may be sufficient cause to help unbalance the scales against a patient whose homeostasis is already delicate and whose margin of safety is hazardous. It is in this respect especially that there is such a marked difference between the young and old in tolerance to operative therapy. There were 66 males and 34 females who were subjected to autopsy. The oldest patient was 91 years of age. The average age was 72 years for both sexes. Table II shows the distribution of autopsies by systems or organs together with the principal and contributory causes of death. Table III gives an analysis of the causes of death. Instructive observations from these autopsies will be incorporated in various pertinent sections of this article. Other observations can be briefly summarized as follows:

Bronchopneumonia and heart failure with accompanying pulmonary edema equally caused a little more than half of the total deaths.

Deaths following gastrointestinal operations were caused in most instances by peritonitis the result of existing perforation at the time of operation or subsequent leakage of the suture lines. Palliative gastroenterostomy for carcinoma of the

stomach would better have been done as far away from the neoplasm as possible and preferably with a Murphy button. Suture lines are then unnecessary and greater operative speed lessens the chance of cardiopulmonary death. Two patients with carcinoma of the colon came to operation too late. They had obstruction perforation with peritonitis and general metastases. Peritoneal metastases predisposed to peritonitis, even when only an exploratory celiotomy was performed. All the cases of intestinal obstruction were unduly delayed for operative therapy. The patients were vulnerable to mesenteric vessel damage, gangrene of the bowel and peritonitis.

Acute abdominal conditions in the aged are frequently difficult to diagnose. One patient had an appendectomy in the presence of a diverticulitis of the sigmoid.

Among the 20 patients who had operations on the genitourinary tract there were 13 with pyelonephritis. Eight in this group succumbed. The remainder died of cardiopulmonary complications which included bronchopneumonia and occlusion of the coronary artery.

The major cause of death in operations for biliary tract disease was bronchopneumonia. Two patients died of occlusion of the coronary artery. One of these should not have been subjected to operation because of a recent coronary attack. He died during the induction of anesthesia. One patient died of gastrointestinal hemorrhage. In this instance common duct obstruction with jaundice was too prolonged.

Patients with mid thigh amputations for arteriosclerotic gangrene died mostly from massive thrombosis in the intra abdominal or intrathoracic vessels, whereas amputees for diabetic gangrene died of systemic complications such as bronchopneumonia, sepsis or pulmonary edema.

Bronchopneumonia or embolism took its toll of those who had operative fixation for fracture of the neck of the femur.

Sepsis predominated as a cause of death in pyarthrosis.

Among the contributory causes of death, unsuspected pyelonephritis, metastatic carcinoma, bronchopneumonia, coronary occlusion and pulmonary tuberculosis were impressive.

**Emergency surgery.** Conduct W. Cutler Jr. presented a paper from our service before The American Surgical Association in March 1947 on his observations in 188 consecutive emergency procedures of many types in people over the age of 60 (average age 74). The mortality rate was 44 per cent. These cases occurred between the years 1939 and 1946 and represented patients who were

TABLE II — ANALYSIS OF 100 CONSECUTIVE AUTOPSY PROTOCOLS IN PATIENTS OVER 60 YEARS OF AGE. ALL THE PROTOCOLS WERE VARYING DEGREES OF ARTERIOSCLEROSIS, VALVULAR DEFECTS,

Distribution of lesions in gastrointestinal

Group	Diagnosis	Male	Female	Total	OPERATION			
					Radical	No	Palliative	No
I	Carcinoma of the esophagus		—		Resection			
II	Carcinoma of the stomach	3	3	6	Gastroenterostomy Suture of perforation	3	Explanatory ostomy	
III	Carcinoma of the spleen						Colectomy	
IV	Carcinoma of the rectum			3	Coccygostomy and ileoanal anastomosis		Colectomy	
V	Carcinoma of the colon						Ileostomy	
VI	Intestinal obstruction	3	3		Ileocecal resection Reduction of volvulus Ventral hernioplasty Division of adhesions	3	Explanatory colectomy Ileostomy	3
VII	Diverticulitis of the colon		—				Explanatory colectomy Appendectomy	
VIII	Gastric ulcer				Gastroenterostomy		Explanatory colectomy	
IX	Appendicitis				Appendectomy		Colectomy	
X	Foreign body perforation of ileum		—				Coccygostomy	
XI	Gilbert's disease of mouth		—		Excision and drainage			
Total		3	3	6		3		13

Distribution of lesions in extremities

I	Arteriosclerotic gangrene	6		7	Mid thigh amputation	7		
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AGE, WHO DIED WITHIN 1 MONTH AFTER OPERATION THE FINDINGS COMMON TO PRACTICALLY CORONARY SCLEROSIS, AND MYOCARDIAL, RENAL, AND LIVER DAMAGE

tract and causes of death in 31 patients

## CAUSES OF DEATH

Principal Cause of Death				Contributory Cause of Death			
Cardiac dilatation, pulmonary edema, pleural effusion							
Bronchopneumonia							
Cardiac dilatation, pulmonary edema	1	3	Popliteal venous thrombosis	Bronchopneumonia		Metastases	4
				Bronchopneumonia		Metastases	
Pulmonary artery thrombosis and bronchopneumonia	1	1			Femoral thrombosis	1	Metastases
Bronchopneumonia and lung abscess, cardiac dilatation, pulmonary edema							
Cardiac dilatation, pulmonary edema	1					Metastases	
Lung abscess, bronchiectasis	1	4	Deer	1	Bronchopneumonia	Pyelonephritis	
Bronchopneumonia, pulmonary edema	1						
Cardiac dilatation, pulmonary edema, bronchopneumonia	1						
Aspiration pneumonia							
Pulmonary edema							
		8		Bronchopneumonia	1	Pyelonephritis	
		9					
		4				Carcinoma of sigmoid	1
		1					
Pulmonary edema	1				Sepsis	1	
	1	17					

and causes of death in 23 patients

Cardiac dilatation, Bronchopneumonia, pericarditis	1	Cardiac dilatation, sepsis	1	Mesenteric thrombosis	Bronchopneumonia	Gangrenous cystitis, gangrene of stump	Contralateral gangrene of foot	1
	1			Pulmonary artery thrombosis		Gangrenous cystitis	Carcinoma of stomach, pulmonary tuberculosis	1
				Abdominal aorta, thrombosis				
				Arteriosclerotic ulcer of stomach with hemorrhage				

TABLE II.—ANALYSIS OF 100 CONSECUTIVE AUTOPSY PROTOCOLS IN PATIENTS OVER 60 YEARS OF AGE. ALL THE PROTOCOLS WERE VARYING DEGREES OF ARTERIOSCLEROSIS, VALVULAR DEFECTS,

Distribution of lesions in extremities

Group	Diagnosis	Male	Female	Total	OPERATION			
					Radical	No	Palliative	%
II	Diabetic gangrene	3			Mid thigh amputation	4		
III	Fracture of the neck of the femur				Hip re-union	4		
IV	Debridement of leg				Mid thigh amputation			
V	Pyarthrosis of ankle b) Bow leg				Mid thigh amputation		Incision and drainage No operation	
VI	Varicose veins						Debridement of varicose ulcers Ligation of saphenous vein	
VII	Thrombosis of femoral artery				Femoral artery anastomosis			
Total						4		4

Distribution of lesions in genito-urinary tract

I	Benign hypertrophy of prostate				One stage suprapubic prostatectomy	5	Suprapubic cystostomy Transurethral resection	5
II	Carcinoma of prostate				Perineal prostatectomy		Suprapubic cystostomy	

AGE, WHO DIED WITHIN 1 MONTH AFTER OPERATION THE FINDINGS COMMON TO PRACTICALLY CORONARY SCLEROSIS, AND MYOCARDIAL, RENAL, AND LIVER DAMAGE.—Continued

and causes of death in 23 patients.—Continued

## CAUSES OF DEATH

Principal Cause of Death				Contributory Cause of Death			
Bronchopneumonia	Sepsis			Subacute pyelitis	Pulmonary tuberculosis		
	Pulmonary edema, diabetic coma					Ulcerative esophagitis	
						Multiple decubiti	
						Nephrocalculosis	
Bronchopneumonia	Cerebellar infarct, renal abscess			Cardiac mural thrombus		Decubitus ulcer	
Bronchopneumonia, pulmonary edema							
Bronchopneumonia, pulmonary edema, hydrothorax							
Bronchopneumonia, pulmonary abscess, empyema				Cardiac dilatation			
Bronchopneumonia	Sepsis			Bronchopneumonia	Acute pyelonephritis	Pulmonary tuberculosis	
Anesthetic death, Cardiac dilatation, pulmonary edema							Decubitus ulcer
							Decubitus ulcer, periphrigis vulgaris
Wound suppuration, pulmonary edema	Sepsis, diabetes				Pyelonephritis, uremia, gangrenous cystitis	Retroperitoneal lymphosarcoma	
		Saddle thrombus of aorta		Acute coronary closure bronchopneumonia			
			7				

and causes of death in 20 patients

Pulmonary edema	Not determined	Gangrenous cystitis	Cardiac dilatation, pulmonary edema			Pyelitis
Cardiac dilatation, pulmonary edema		Bilateral pyelonephritis	Coronary occlusion			Acute pyelonephritis
Bronchopneumonia, pulmonary edema		Pyelonephritis, uremia	Pulmonary congestion			
Bronchopneumonia, lung abscess			Bronchiectasis, empyema			
Bronchopneumonia, coronary occlusion						
Bronchopneumonia, pulmonary edema, cardiac dilatation						
Bronchopneumonia	3				Pulmonary metastases	Pyelonephritis
Cardiac dilatation, pulmonary edema						

TABLE II.—ANALYSIS OF 100 CONSECUTIVE AUTOPSY PROTOCOLS IN PATIENTS OVER 60 YEARS OF AGE. ALL THE PROTOCOLS WERE VARYING DEGREES OF ARTERIOSCLEROSIS, VALVULAR DEFECTS, Distribution of lesions in genito-urinary tract

Group	Diagnosis	Male	Female	Total	OPERATION			
					Radical	No	Palliative	No
III	Vesical fistula		—				Suprapubic cystostomy	
IV	Hydrocephalus		—		Nephrectomy			
V	Renal calculus and diabetes		—		Nephrectomy			
VI	Prostatic abscess		—				Incision and drainage	
	Total	20	—	20		9		

## Distribution of lesions in biliary tract

I	Chronic and acute cholecystitis and cholelithiasis	5	3	8	Cholecystectomy choledochotomy	4	Cholecystectomy	
					Cholecystectomy	4	No operation	
II	Carcinoma of gall bladder and cholelithiasis	—			Cholecystectomy			
	Total	5	3	8		8		1

## Distribution of lesions and causes of

## THORACIC

I	Empyema		—		Thoracotomy and drainage			
II	Carcinoma of the larynx		—				Tracheotomy	

## NEUROLOGICAL

I	Spinal cord tumor			3	Laminectomy	3		
II	Fracture of skull with subdural hematoma	—			Bone-flap evacuation of hematoma			

## PANCREAS

I	Carcinoma of head of pancreas	3	—	3			Cholecystectomy Cholecystogastrostomy	
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TABLE II.—ANALYSIS OF 100 CONSECUTIVE AUTOPSY PROTOCOLS IN PATIENTS OVER 60 YEARS OF AGE. ALL THE PROTOCOLS WERE VARYING DEGREES OF ARTERIOSCLEROSIS, VALVULAR DEFECTS, Distribution of lesions and cases of

Group	Diagnosis	Male	Female	Total	OPERATION			
					Radical	N	Palliative	No.
HERNIA								
I	Sliding inguinal hernia		—		Hernia Repair			
	Total	9	3			8		4
	TOTAL PATIENTS	64	34	100	RADICAL	59	PALLIATIVE	41

extremely bad risks, old and senile poverty stricken afflicted with chronic and degenerative disease and those with nutritional deficiencies. Most of these patients would have succumbed without operation and this was their only chance for survival. Frequently before admission to the surgical service, there was procrastination and an attempt at conservative treatment, so that the surgical risk was increased in many patients. There were a number of understandable reasons for the delay in seeking surgical help in some of the cases. Because of many medical complications, the clinical picture might have been confusing so that a rapid and accurate diagnosis became difficult in the presence of a surgical emergency. The impact of such an emergency frequently caused a rapid deterioration of these very sick people in a very few hours, so that when they reached the surgeon their condition was desperate. Further there is a natural inclination on the part of the physician to delay an operative procedure in old, sick, and feeble patients until it becomes inescapable. In order to hasten the prospects for operative relief additional delay for ideal preoperative preparation was at times precluded especially in intestinal obstruction, biliary tract disease, and spreading infection or gangrene.

A comparison of the relative mortalities in emergency and nonemergency operations showed that the expected mortality rate will be about two and one fourth times greater in emergency than in nonemergency procedures. This figure was arrived at by comparing the 44 per cent mortality in emergency operations mentioned with the 19.4 per cent mortality in nonemergency operations, which were calculated from the statistics from our service mentioned in paragraph two.

**Shock.** Frequently operative mortality which has been ascribed to shock is caused by fundamental pathologic lesions which cannot be seen without autopsy. A discussion of the irreversible shock syndrome as a cause of mortality is pur-

posely avoided because, after an analysis of the autopsy protocols, pathological diagnoses were noted which could adequately explain death. This does not mean that the complex mechanism of shock does not contribute to such exits, especially when there are damaged vital organs, chiefly the kidney and liver.

#### PREOPERATIVE PROPHYLAXIS AGAINST MORTALITY

**Establishment of diagnosis.** Inasmuch as physiological reserve in the aged is diminished, it is extremely important to establish a reasonably certain diagnosis before therapy is attempted. The planning of a surgical procedure then becomes more accurate so that the patient receives the indicated preoperative preparation and is spared the trials of technical fumbling, unnecessary surgical trauma, incorrect or multiple incisions, and lengthy or exploratory operations. Older people do not stand these as well as those who are younger.

**The role of heat and humidity.** The surgical risk in the aged is increased when there is operative intervention on hot and humid days. McConnell *et al.* concluded that saturated still air at 90°F is the upper limit of the environment in which man is able to maintain heat equilibrium. The proper dissipation of heat in patients who undergo major surgery is essential. This is true especially in those who live in a temperate climate and who, because of their basic metabolism, may be particularly sensitive to heat and humidity. The ability to control normal body temperature has been found deficient in those with disease of the nervous system (19). Leucocytes are increased in those who have prolonged exposure to high temperature, and it is possible that an exhaustion of this defense mechanism might result (19). The syndrome recognized as "postoperative heat stroke" can be avoided if elective procedures are postponed from a hot to a cooler day and if the blood chloride and fluid loss following excessive perspiration are controlled by appropriate measures.



There are a number of standard accessory therapies with necessary variations, which depend upon the clinical condition and chemical status of the patient. Among these are infusions with blood or its substitutes, with amino acids, or with glucose and saline solution. In addition, there are available nasal tube feeding and oral feeding of palatable chocolate-flavored amino acids, hydrolysates, skimmed milk powder (Varco) vitamins, liver extract, or folic acid when indicated.

**The control of diabetes** The question of the control of sugar metabolism in surgical diabetes is answered by two schools of thought. One school permits diabetic patients to "spill over" 50 grams or more of glucose in the urine daily provided that enough protamine insulin is used to maintain good nutrition and to prevent ketosis and/or such clinical symptoms of diabetes as polyuria and thirst. The other school uses every available method to control the diabetes so that the blood sugar approaches normalcy. In diabetes there is a greater incidence of degenerative diseases, infection gangrene poor wound healing, and acidosis. A controlled diet and the use of insulin, therefore, are indicated to help tide over the surgical diabetic and spare him a continued hyperglycemia with its harmful end results. There is one contraindication to this program. Some diabetic patients react to a sudden lowering of the blood sugar to a comparatively normal figure by attacks of angina pectoris which are precipitated by coronary artery spasm or coronary artery occlusion. Generally speaking however the use of insulin, glucose, water and salt are enough to glycogenize and hydrate the patient.

**Cardiac status: presbycardia and digitalis therapy** All the autopsies indicated that there were varying degrees of cardiac valvular defects and/or valvulitis with cardiac dilatation or hypertrophy. There were also constant findings of varying degrees of coronary sclerosis with myocardial fibrosis, and often old and infrequently (5 per cent) recent, myocardial infarcts. These observations and electrocardiographic and physical findings confirmed the fact that the myocardium in the aged is weakened and its reserve is impaired. It is therefore to be expected as pointed out by Dry that the mechanisms of cardiac deaths are likely to be congestive heart failure from exhaustion of the cardiac reserve, sudden coronary occlusion ventricular dysfunction as a result of interference with the conduction system peripheral circulatory collapse, or massive pulmonary embolism. A note of optimism was sounded by Ochaner when he said, "I think that it would be unfortunate should surgeons receive the impression that patients

suffering from heart disease are especially safe. I believe that they are safe because they are considered especially unsafe.

When a prospective life-saving operation is necessary angina pectoris of organic origin does not contraindicate a technical procedure. The almost universal presence of coronary artery disease in our autopsy findings and the small incidence of acute coronary artery occlusion seem to support this statement. Other investigators have come to the same conclusion. Blumgart *et al.* reported that there were no operative deaths in 25 patients who had complete ablation of the thyroid gland for angina pectoris. Brumm *et al.* found that of 257 patients who had coronary artery disease and who underwent major surgical procedures, 22 had healed myocardial infarcts and the remainder had angina pectoris. Only 4.3 per cent of this group had cardiac deaths and 7 of the 11 deaths could be attributed to coronary thrombosis. Master and his coworkers studied a total of 625 attacks of coronary artery occlusion which were substantiated by autopsy and/or clinical and electrocardiographic findings. Two-thirds of the patients were past the age of 60 and 5.6 per cent of the total number had the coronary occlusion within 3 weeks after an operation. It is possible that some of these patients might have had attacks without an operation, since they all had disease of the coronary artery.

When the beneficial effects of digitalis on a weakened and dilated heart are considered, the direct action on the muscle usually takes precedence over the inhibitory action on the vagus, so that the relaxation of the ventricle during diastole is less than before the administration of the drug. The various heart irregularities, whatever their causes, are usually controlled by digitalis. In view of these facts, it has become our practice to prepare elderly patients for operation by digitalization, unless there is some contraindication to its use, such as heart block. There are some who differ with this concept, especially those who fear the thromboplastic properties of digitalis, which have been shown experimentally and clinically by Macht and by Masale *et al.* However an increased cardiac reserve not only minimizes the chances of heart failure, but helps to prevent stasis in the pulmonary circuit. Stasis ordinarily predisposes to pulmonary congestion and offers a locus minoris resistentiae for pneumonia and pulmonary edema. Indeed most terminal pneumonias may be ascribed to this mechanism.

Embarrassment of the circulatory system by overloading it with fluids and by increased intra-abdominal pressure with its harmful effect on

cardiac action are to be avoided. Generally subdued activity out of bed several days prior to operation may diminish slowing of the blood stream and consequent predisposition to thrombosis.

**Chemotherapy** It is generally conceded that the control of intercurrent infections has reduced the morbidity and mortality of the degenerative diseases which accompany the aging process. The least toxic of the antibiotic agents is penicillin and this is tolerated particularly well by the aged. Indiscriminate use of penicillin has been severely criticized. However pneumonia, pyelonephritis, and secondary infection are so commonly present as postoperative complications with their concurrent deleterious effects on the blood forming organs that the routine prophylactic preoperative use of penicillin for 48 hours before major geriatric surgery seems justifiable even in cases which have no obvious infection. The same program is continued for 48 hours after operation.

In preparation for operations on the intestinal tract, the comparative elimination of pathogenic bacteria in the intestinal flora by streptomycin and by sulfonamides such as sulfathiazole and succinylsulfathiazole has done much to minimize infection and peritonitis in spite of putrefaction promoted by a high protein diet. The classical methods of minimizing such putrefaction should not be overlooked namely, bowel cleansing by saline cathartics and by enemas or colon irrigations.

**Psychological approach** The elderly patient frequently has fixed ideas about the living the dead and the future. He may accept an imminent surgical experience with a calm and fatalistic philosophy. On the other hand, he may be negativistic and resistant, with resulting lack of co-operation. It is this kind of patient who is ready to give up and "lay down and die." He must therefore be conditioned to a more hopeful outlook by a radiant, confident, and optimistic bedside approach and by the demonstration of a keen interest in his welfare. The surgeon can resort to harmless compliments and judicious, constructive flattery. In interviews with ministers in the various religious groups have proved their value in preoperative mental conditioning.

**Timing of operation.** The clinical eye and surgical judgment must decide the timing and the amount of operative therapy. Conservatism at the wrong time, such as procrastination or operative therapy which is too late, may be one of the greatest causes of operative death. This is especially applicable to infections, gangrene, malignancy and the obstruction in various systems. Prolonged "work-ups" when a diagnosis has been established with reasonable certainty very often

TABLE III.—CAUSES OF DEATH

	Principal causes	Important contributory causes
Bronchopneumonia	28	10
Cardiac dilatation	27	3
Pulmonary edema		
Peritonitis	18	1
Thrombosis and embolism	7	2
Sepsis	7	1
Pyelonephritis	6	15
Coronary occlusion	3	2
Anesthesia	3	—
Lung abscess	1	—
Metastatic carcinoma	1	12
Decubitus ulcers	—	5
Pulmonary tuberculosis	—	3
Bronchiectasis	—	2
	100	

turn the delicate scales against the patient. Stasis promotes infection and disturbed metabolic, fluid, electrolyte and nitrogen balance. Obstruction in the biliary tract, the urinary tract, the gastrointestinal system and the pulmonary tree call for as prompt surgical intervention as is compatible with adequate and safe preparation of the patient for operation. By way of illustration the rate of operative mortality in obstructive lesions in the biliary tract is heightened by cholemia and cholangitis caused by unnecessary delay. Analogous situations arise in other systems. Early relief of obstruction is mandatory. Preliminary decompression of the gastrointestinal and urinary tracts by one of the various tube devices can be life-saving and produce a smoother postoperative course.

#### OPERATIVE PROPHYLAXIS AGAINST MORTALITY

**Anesthesia** Proper anesthesia is one of the major factors which contributes to a safer operative and postoperative period. The skilled anesthesiologist, armed with the newer concepts in chemistry physiology and pharmacology as they relate to surgery, usually determines the type of anesthesia after analysis of the hospital record and after consultation with the surgeon. Measures to alleviate excitement immediately before operation are especially indicated in the aged. The choice and dosage of preoperative sedation are selective. As a general rule, minimal sedation is advisable. Smooth induction of anesthesia in appropriate anesthesia rooms is highly desirable. The new experience may be grotesque and frightening to patients if induction is accomplished in the operating room. The clash of instruments the hiss of sterilizers men and women in white, and a disturbing word which is dropped inadvertently may all contribute to unnecessary excitement.

An evaluation of anesthetics in geriatric surgery has been made in a previous communication (10). The success of local anesthesia is dependent upon its technical application and upon the patient selected. For example local anesthesia is highly satisfactory in procedures for decompression of abdominal viscera, the repair of inguinal hernias, and the excision of superficial growths. The use of novocaine (1 per cent) without the addition of adrenalin, is preferred because the adrenalin tends to make the patient excitable and nervous. It is also better to detect and to tie bleeders than to promote temporary blood vessel constriction by adrenalin.

Spinal anesthesia with its various refinements, is very helpful in prolonged lower intra-abdominal procedures and in amputation of the lower extremities. It is contraindicated in patients with organic disease of the central nervous system and in those with deformity or arthritis of the spine. It is also contraindicated in those with marked hypertension or nephritis, in whom the accompanying drop in blood pressure may cause an acute suppression of renal function.

All inhalation anesthetics should be accompanied by ample oxygenation. Cyclopropane seems preferable to all other inhalants. It is less toxic and makes for the smoothest postoperative recovery. Ethylene has been discontinued because of its explosive risk and its tendency to cause anoxia. Ether administered by the open-drop method is still a good supplemental and stimulating anesthetic. Nitrous oxide and oxygen is useful for short anesthetics.

Avertin anesthesia in the aged should be used with a great deal of caution. It is contraindicated in those with diminished cardiac reserve, liver disease, chronic pulmonary conditions, and in those who are in shock. If the patient does badly during operation, it is difficult to prevent further action of avertin and he may just "sleep away."

The intravenous use of sodium pentothal for short operative procedures is gaining favor.

Curare as an adjunct to the lighter anesthetics is gradually becoming more acceptable, especially in upper abdominal procedures. The pure alkaloid yields an agent which produces complete muscle relaxation by interruption of the normal action of acetylcholine at the myoneural junction. This eliminates broncho-spasm.

A stomach empty of food during operation helps to guard against vomiting with its attendant risk of aspiration, choking, atelectasis, or aspiration or lipid pneumonia. Suction of the nasopharynx to dispose of excess mucus should be routine.

Some of our concepts in crymal anesthesia need revision. We have recently noted that in the average case there is no more shock after amputation with a well selected general anesthetic than with crymal anesthesia. Three of 4 patients in our autopsy protocols who had mid thigh amputations for arteriosclerotic gangrene died of massive thrombosis in the large vessels. All these patients were operated upon under crymal anesthesia with the tourniquet technique. We must suspect, therefore that the tourniquet by causing unnecessary trauma to blood vessels already diseased, may cause extensive thrombosis. It seems logical that in amputations for all peripheral vascular disease the tourniquet is contraindicated. Crymal anesthesia without the tourniquet technique, is indicated for patients who are extremely bad risks and for those who have spreading infection.

*Technique* In geriatric surgery especially technical procedures which are too late, too little or too much may be great predisposing factors to mortality. When the head and hands work together when there is a minimum of lost motion and tissue trauma, and when there is meticulous attention to hemostasis, the precipitation of irreversible shock and of postoperative storm are unlikely. An unskillful and time-consuming cholecystostomy certainly involves more risk than a skillful and rapid cholecystectomy. Indicated stage operations reduce mortality. Disembowelment in abdominal procedures, especially in intestinal obstruction, should be guarded against as far as possible. Through-and-through abdominal sutures can be life-saving when a lengthy operation produces an imminent hazard. Retention sutures in celiotomies, careful approximation of tissue planes, and nonabsorbable suture material lessen the possibility of wound disruption.

Amputation stumps on the operating table have created a perplexing problem to many as a result of recent war directives and war experience. For practical purposes, the Surgeon General's Office deemed it advisable to adopt a standard method of amputation leaving the stumps open and applying traction. A war wound in a comparatively young man, which necessitated a mid thigh amputation almost always had a virulent mixed infection plus a latent period before operative therapy could be carried out. Medical officers became so thoroughly indoctrinated with the principle of traction on stumps which were left open, that some of them have permitted this practice to become standard in amputations for peripheral vascular disease as well. Other surgeons maintain that civilian experience has taught them that results will be good when most mid thigh amputa-

tions for peripheral vascular disease are handled by tight or loose closure according to the clinical condition and the extent of blood vessel involvement which are ascertained during operation. They are convinced that most stumps heal satisfactorily and quickly and that when the other technique is used wounds take much longer to heal aseptically and nitrogen balance are difficult to maintain, and an end-bearing stump is produced which is far from satisfactory and frequently in need of revision. Unless there is obvious ascending infection or marked thrombosis of the femoral vessels in arteriosclerotic or diabetic gangrene it has been our practice to close stumps by the approximation of muscle fascia and skin. Should there be evidence of wound infection or breakdown appropriate measures are taken. Generally the results have been better with this program.

**Supportive therapy** This strives to overcome the hazards of anesthesia, operative trauma, blood loss, a negative fluid electrolyte, and nitrogen balance and the impaired function of vital organs. A good anesthesia with ample oxygenation, a continuous intravenous drip of whole blood, plasma, human serum albumin, or glucose in saline solution, and the use of analeptics such as synephrin in patients who are in a shock state, all contribute to a safer operative procedure. Old patients can take more than 500 cubic centimeters of blood or other fluid intravenously with far greater safety than is generally supposed, provided that the drip rate is regulated to serve the clinical condition of the patient. As the diminished elasticity of the vascular system with its concomitant lack of adaptability to rapid changes in blood volume may put an increased load on the already damaged heart and result in acute cardiac dilatation. Improved color, pulse, and blood pressure readings indicate the necessity for a slower infusion rate.

#### POSTOPERATIVE PROPHYLAXIS AGAINST MORTALITY

**Supportive therapy** This aims to correct shock induced by blood loss and trauma, and to restore impaired circulatory function and nutritional balance. The value of whole blood in the first two and its beneficial effect on the circulatory and kidney functions are established. There is no ideal substitute for oral food intake. When there are factors which vitiate comparatively normal assimilation or when tube feeding is difficult, parenteral alimentation serves its supporting and life saving purpose. Elman, Werner, Koop (21), Fagerstrom, and Mason and Zintel have discussed basic principles for the maintenance of nutrition in surgical patients with particular emphasis on nitrogen, fluid, and electrolyte balance. In view of the dis-

turbed cardiac and kidney functions in the aged the margin of safety for intravenous infusion is diminished and in selected cases it may become advisable to use clyses. Patients who have salt retention or in whom this is induced by too high salt administration become susceptible to water retention and fixation of extracellular protein. A urine with a specific gravity below 1.015 points to adequate hydration and it is desirable that the output should be at least 1,000 cubic centimeters. The average daily water requirement is 2 liters. This may have to be doubled in patients who have suffered dehydration through vomiting, diarrhea, intestinal fistulas, anorexia, excess perspiration, or gastrointestinal decompression. Mulholland *et al* (31), Brunschwig *et al*, and Casten *et al* have made studies to show that there is postoperative nitrogen loss. One gram of protein per kilogram of body weight is an average daily requirement but after operative or other traumas such requirement may have to be doubled or tripled in order to maintain a positive nitrogen balance. Lowered physical activity can diminish nitrogen metabolism, but a high carbohydrate intake may compensate for this. Hydrolyzates and parenteral administration of pure amino acids furnish a high nitrogen intake. The rapidity with which the amino acids may be given may facilitate early ambulation and better sleep. It is advisable to provide glucose and salt apart from the amino acid mixture. The use of one-sixth molar sodium lactate solution to prevent acidosis is indicated. The parenteral maintenance of a nitrogen balance is continued until the daily food intake provides it.

**Early ambulation** It is generally conceded (23) that this radical departure from past practice with its tendency to prompt promotion of normal function has had a definite effect in the reduction of postoperative morbidity and mortality and has proved to be a conservative procedure. Over 30 years ago one of our teachers of surgery at the College of Physicians and Surgeons, Columbia University, the late William Cogswell Clarke, preached a surgical sermon of early in bed mobilization of postoperative patients and he exhorted his students to let em kick their legs around. He feared the bad effects of a slowed circulation. Education of the public has dispelled the fear of early ambulation and contributed to confident co-operation. The method has cut in half postoperative pneumonia, distention, difficulty in urination, elevation of temperature, wound disruption and thrombosis. Formation of bed sores has been diminished, atrophy of disuse lessened, vital capacity increased, and the cough reflex stimulated. Morale has been strengthened, appetite,

sleep, and strength improved, and the necessity for sedation diminished. Hospitalization and expense have been curtailed. It has been gratifying to note that, especially in geriatric patients, the earlier the ambulation, the better. For example, practically all of our patients have inguinal hernia repair under local anesthesia and they are encouraged to walk and use the bathroom on the day of operation. A patient who has an abdominoperineal resection sits in a chair the day after operation and takes a few steps. Early ambulation is interdicted in those who are in danger of imminent cardiac failure or who have hyperpyrexia, weakness, profound shock, or severe hemorrhage.

**Oxygen therapy.** This is routine for at least 24 hours after operation for patients who have had the more major surgical procedures, especially those in the upper abdomen. Oxygenation in the aged, many of whom have some type of anemia or local or general anoxia, increases the oxyhemoglobin with the result that pulmonary and tissue respiration is better and easier, vital capacity is increased and the cardiac load is diminished. In order to obviate oxygen want, it is essential to relieve respiratory depression, obstruction in the respiratory system, shock, and oxygen replacement by other gases. A 50 to 100 per cent increase in concentration of alveolar oxygen is desirable. The administration of 100 per cent oxygen causes a 10 to 15 per cent increase in oxygen in the arterial blood and a slightly higher increase in the venous blood (6). This can reduce the mortality in shock (4, 17) acute cardiac decompensation, circulatory failure, pulmonary edema, pneumonia, and abdominal distention. When the use of an oxygen tent is impractical, oxygen insufflation may be substituted with the help of an oxygen mask, an oropharyngeal catheter or nasal cannulae.

**Phlebothrombosis thrombophlebitis and embolism.** The highest incidence of thrombosis is likely to occur in the older age groups (2) and during the colder months (16). The major etiologic factor is stasis in the deep leg veins. In our autopsy findings unsuspected massive thrombosis occurred in 9 per cent of the patients. In 7 per cent, this was the principal cause of death. Thrombophlebitis with its evident symptoms and signs, is usually recognized early and easily provided that a careful, routine daily examination of the lower extremities is made. The thrombus of phlebothrombosis, however, is more insidious, and difficult to diagnose. The presence of compensatory dilatation of superficial veins, edema of the ankle, cyanosis of nail beds, calf tenderness, and Homan's sign suggest the presence of phlebothrombosis,

especially if the temperature, pulse, and respirations are mounting. Embolism may be easily overlooked, but if it is diagnosed it may be the first lead in the recognition of the basic pathological condition. In this connection, it is suggested that the descriptive adjective "bland" associated with the thrombus should be abandoned for no thrombus can be bland in view of its potential embolic hazard.

Early ambulation in its strictest sense, has been the most potent prophylactic against thrombosis. The observations of Morton and his associates on thrombosis and embolism, based on autopsy findings, are significant. They emphasize, among many other things, the most common incidence in the sixth, seventh and eighth decades, and the tendency toward fatal embolism in patients with impaired cardiac action. The "jackknife" position in bed predisposes to puddling in vessels near the popliteal and femoral creases. These authors recommend slight elevation of the extremities in extension. Allen (1) is convinced that geriatric patients should have prophylactic interruption of both superficial femoral veins in order to guard against thrombosis and embolism. His conclusion is based on a well controlled group of 458 cases. He is averse to the use of anticoagulants in the aged if they have metabolic, renal or liver disturbance, arteriosclerosis, or hemorrhagic diathesis. We have not hesitated to use heparin and dicumarol in indicated cases of thrombosis, provided that there is a daily check on the prothrombin time. For the present we prefer this therapy together with early ambulation, to the use of prophylactic ligation of the superficial femoral vein. It is possible that this concept will change. Vein ligation above the clot, thrombectomy and the use of anticoagulants for phlebothrombosis, especially if complicated by embolism, is an accepted procedure. When femorofemoral thrombophlebitis is the presence of repeated infarcts is suspected, life-saving ligation of the common iliac vein or inferior vena cava may have to be performed (Neal et al.). Aycock and Hendrick have had remarkably good results in thrombophlebitis from paravertebral lumbar sympathetic block with 1 per cent procaine hydrochloride and monobromsaligenin.

**Decubitus ulcers.** These, often multiple, are commonly seen in aged surgical patients, especially those who have neurological conditions. The most frequent sites are in the sacral trochanteric, calcaneal and scapular regions. Our autopsy statistics show that decubitus ulcers were the contributory cause of death in 5 per cent of the patients. Like all open wounds, they frequently initiate a serious downhill clinical course by de-

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pletion of protein reserve and at times, by sepsis. Their debilitating effect produces anorexia and diminished resistance to infection resulting in a vicious cycle of persistent chemical imbalance or sepsis unless appropriate therapy is vigorous. A significant contribution to such therapy was made by Mulholland *et al* (32) who demonstrated that decubitus ulcers will heal quickly if hypoproteinemia is reversed and a positive nitrogen balance is maintained. Additional therapy which has yielded the best clinical results is the relief of local pressure by early ambulation, repeated change of position in bed, rubber rings and air mattresses, the maceration of skin due to incontinence. Basic surgical principles in the local treatment of the ulcer are indicated.

We have tried without success plastic closure of some of the larger decubitus ulcers. The successful results which have been obtained by this procedure in young soldiers are difficult to duplicate in the aged because of circulatory and nutritional disturbance diminished resistance to infection and in some cases incontinence.

**Pneumonia** The high morbidity and mortality of postoperative pneumonia make this one of the major problems in geriatric surgery. This disease was the principal cause of death of almost one third of our patients. The stealthy clinical syndrome the masked and sometimes absent physical signs the unpredictable temperature curve and the common absence of cough all contribute to make it easy to overlook the diagnosis, especially if the patient has antibiotic therapy. The most reliable diagnostic aid is the chest roentgenogram. The most important signs are increase in pulse and respiratory rate. Good anesthesia early ambulation deep breathing supportive cardiac therapy and the routine postoperative use of penicillin and oxygen are the strongest prophylactic measures.

**Fresh air and sunshine** The influence of the physical and mental stimulation of fresh air and sun line with the associated change in scenery cannot be overemphasized. One of the characteristics of aged ward patients is an inertia which tends to make them congregate in groups in rooms even when weather conditions are favorable. They have an unfounded fear of drafts and pneumonia especially in the winter months. Recently on a mild and beautiful grand rounds day, most of the ambulatory male patients were found seated in the day room. One of the old men was told to take a advantage of the outdoor on a porch. He took a long time to get up and when he did he was so tired that he was unable to walk. He was then taken to the day room and he was so tired that he was unable to walk.

Attractive day room, mild recreation such as checkers and card games, reading and various forms of occupational therapy help create a resistance to the outdoors. It is part of the job of the nursing staff to overcome this resistance.

## SUMMARY

The morbidity and function of the surgeon in geriatric surgery are becoming more important because of the progressive increase in the span of life.

The principal and contributory causes of operative mortality are enumerated from an analysis of 100 consecutive autopsy protocols of extreme old patients who died within a month after surgery. The three outstanding principal causes of death were bronchopneumonia (8 per cent), arterial dilatation and pulmonary edema (per cent), and peritonitis (15 per cent). Other principal causes of death were thrombosis and embolism, sepsis, pyelitis, urinary occlusion, aneurysm, central nervous system, the three outstanding causes of death were pyelonephritis, metastatic carcinoma and bronchopneumonia. Most of the death after biliary tract operations were caused by arterial pulmonary embolism after general urinary operations by peritonitis and urinary catheter and pyelitis.

The importance of early operative intervention in the geriatric operative patient is emphasized. The technique is emphasized. It is to be expected that deaths from emergency operations will be about two and one quarter times greater than deaths from non-emergency operations.

There are various measures which help in preoperative preparation against mortality. It is important to establish a reasonably correct diagnosis in order to plan a surgical procedure. Old people do not tolerate surgery well in hot humid weather. The importance of a good nutritional electrolyte and fluid balance in the preoperative period is stressed. Good ventilation and resistance to infection by being alert to the maintenance of comparative normal vital signs in diabetes is emphasized. Because of the patients die of cardiac failure, it is emphasized that preoperative therapy may be helpful to the thrombotic tendency of diabetes. Careful attention to the care of the patient in the preoperative period is not a contraindication to surgery. Preoperative preparation of the patient is emphasized and postoperatively is recommended.



psychological approach to the patient and an optimistic bedside manner are very constructive. Many patients die because conservatism at the wrong time brings them to operation too late. This is true especially in conditions which involve infection, gangrene, malignancy and obstruction in various systems.

6. There are various measures which help in operative prophylaxis against mortality. Anesthesia for the aged is evaluated. Cyclopropane is the preferred general anesthetic. All general anesthetics are best when accompanied by ample oxygenation and at times by curare. Cryanal anesthesia for lower extremity amputations should be limited to those patients who are extremely bad risks or to those who have spreading infection.

Reasonable speed, gentle manipulation, and careful hemostasis are all part of a good technical procedure. The use of a Murphy button for palliative gastroenterostomy in carcinoma of the stomach is recommended. Except in obvious ascending infection in peripheral arteriosclerotic or diabetic vascular disease, it is preferable to close amputation stumps loosely or tightly according to the findings at the time of operation. The use of a tourniquet is interdicted because the blood vessels are vulnerable to thrombosis.

The use of supportive therapy by the parenteral administration of blood, blood substitutes, glucose, and saline solution has been life-saving.

7. There are various measures which help in postoperative prophylaxis against mortality. Supportive therapy for shock, the correction of impaired circulatory function and the maintenance of nitrogen, fluid, and electrolyte balance are presented. Early ambulation, oxygen therapy, the detection and therapy of phlebotrombosis, thrombophlebitis, embolism and pneumonia, and the prevention and therapy of decubitus ulcers, all contribute to lessen morbidity and mortality. The importance of good nursing, fresh air and sunshine is emphasized.

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# ABSTRACTS OF CURRENT LITERATURE

## SURGERY OF THE HEAD AND NECK

### HEAD

**Classification of Extensive Cysts of the Jaw** G  
VICTOR BORKO *J Oral Surg.* 1947 5 325

The present study centers chiefly around odontogenic cysts. Usually unilateral such cysts may reach extensive proportions and erode through the bone. Those in the maxilla may obliterate the antrum extend into the orbit the pterygoid fossa and invade other vital structures.

The most common type of cysts are the radicular cysts which extend from the periapical regions. These are usually detected during routine oral examinations and are therefore seldom productive of marked tissue damage.

The second type or the follicular group of cysts results from retrograde changes during tooth development with subsequent enlargement of the enamel organ. The stage at which changes occur determines whether the follicular cyst is to be simple dentigerous periodontal odontogenic, or multiple. When extensive follicular cysts particularly of the dentigerous type may contain potential ameloblastoma tissue.

The third group the ameloblastoma or a laminar blastoma, possesses invasive and destructive properties and necessitates wide excision. Traumatic or hemorrhagic cysts and cysts arising from embryonic fissures though not odontogenic may present similar findings and often lend themselves to the same form of treatment as the radicular and follicular types. In combination with x-ray studies the injection of lipiodol into the cyst may be of aid in establishing a diagnosis. The diagnosis however may remain in doubt until aspiration or several tissue biopsies (or both) are performed.

When essential teeth or vital tissue structures are uninvolved, the lesion is enucleated or the cystic membrane is everted, care being taken to avoid deformity and to maintain normal function by preserving as much of the alveolar ridge and muscles as is safe. In the presence of ameloblasts and lesions with malignant tendencies radical resection often followed by radiation therapy, is urged.

Exposed teeth may be retained as pulpless teeth after their devitalization or they may be left in temporarily to aid in the healing process. However when extensive cysts encroach on vital structures conservative operations may be substituted. The open or Parnis procedure consists in placing a window in the most accessible portion of the cyst thereby converting it into an accessory part of the oral cavity. Similarly communication may be established by means of a foreign body which permits drainage and allows irrigations to be carried out until the cyst shrinks and healing occurs. In some

instances a portion of the lesion may be removed in a radical manner whereas the balance of the cyst may be treated more conservatively. Moreover era location becomes possible occasionally only after a preliminary conservative operation has been performed.

The approximation of soft tissue edges the immediate use of appliances to retain bone fragments in a functional position the institution of oral hygiene the use of flaps with which to combat infection just operative exercises and physiotherapy are all helpful in achieving a successful result.

DAVID H. LANE M.D.

**The Use of Vitallium Plates to Maintain Function following Resection of the Mandible** D.S. FARR  
U.S. *PL & Reconstruct Surg* 1948 3 73

Resection of the mandible necessitates immediate postoperative fixation of fragments to prevent external and internal rotation resulting in respiratory distress feeding problem and severe deformity. In a fault with teeth retention of the proper relationship between fragments with the later restoration of bone continuity can be accomplished with intramedullary wires or dental plates. In edentulous adults and in children retention of the fragments is difficult. Immediate retention of the fragments is difficult because of either oral contamination or incomplete fixation of the fragments. Following resection of a sizable portion of the mandible without stabilization the mental anguish and depression resulting are secondary to the immediate use of Vitallium plates fixing both fragments firmly in their original place and maintaining rigidity of the mandible during the period between operations have been successfully used to prevent these sequelae.

Simple Sherman type plates of vitallium in varying sizes can be bent to proper curvature in the operating room. If necessary a specially curved plate can be prepared in any dental laboratory equipped to make vitallium prostheses. The area to be resected is outlined the metal plate is bent to the approximate desired curvature with a pair of pliers or the fingers the positions of the plate holes are marked with drill holes made into the bony part to be left. After the oral cavity has been closed tightly the wound irrigated and the instruments and gloves changed the plate is attached by small vitallium screws or bolts.

Even in the presence of wound infection metal plates can be allowed to remain in position for a considerable period of time in order to stabilize the bone fragments and repair them if necessary for a later graft.

LOUIS T. BRACK M.D.

## EYE

**The Problem of Sympathetic Ophthalmia.** BEN MARD SAMUELS. *Irish J. M. Sc.*, 1947, 26:1-610.

The problem of sympathetic ophthalmia is discussed. The author points out that the disease is characterized by the appearance of a specific infiltration in the pigmented and highly vascular uvea. This infiltration is composed of three elements: lymphocytes, epithelioid cells, and giant cells. Artificially made openings of the eyeball with incarceration of uveal tissue generally result in sympathetic ophthalmia.

Wounds of the sclera in the danger zone, i.e. over the ciliary body, are more serious than wounds elsewhere because of the greater tendency of the uvea to prolapse. Ruptures at the limbus are most grave because the root of the iris, alone or together with the ciliary processes, may become incarcerated. The larger the perforation the greater the hazard.

Enucleation, iridectomy, and repair of iridodialysis are unsafe procedures. Cataract extraction with a flap incision is considered much safer than linear extraction. Sympathetic ophthalmia may follow operations for glaucoma regardless of the size of the opening but not operations for detachment of the retina. Generally speaking, as long as an eye remains hard after an operation the probability of sympathetic ophthalmia is remote. Cataract extraction and operations for glaucoma are the two most common surgical procedures which result in sympathetic ophthalmia.

From 2 to 13 per cent of all cases of sympathetic ophthalmia originate in eyeballs with post-traumatic endophthalmitis septica.

The incidence of sympathetic ophthalmia after septic panophthalmitis is about 3 per cent.

The presence of an intraocular foreign body makes the eye sensitive and may excite irritation of the other eye.

Clinically sympathetic irritation precedes the pathologic signs of sympathetic inflammation. Irritation is a warning of impending sympathetic ophthalmia. It disappears within a few days after the enucleation of the injured eye. Actual inflammation begins in the uninjured eye with disturbance of vision, pain, fine grayish precipitates on the posterior surface of the cornea, adhesions, vitreous opacities, and characteristic sharply defined small yellowish patches in the choroid.

In genuine sympathetic iritis (iritis maligna) the entire posterior surface of the iris is agglutinated to the capsule of the lens, unlike iritis serena in which the pupil is free or plastic iritis in which incomplete adhesions are confined to the pupillary zone. The presence of grayish nodules at the pupillary border and on the lens capsule is considered the most significant clinical sign of sympathetic ophthalmia in the anterior chamber.

Various theories have been presented to explain the pathogenesis of sympathetic ophthalmia—allergy and infection (tuberculosis or virus infection).

The time to enucleate the injured eye is (1) when the fellow eye is irritable, even if it be apparently normal (2) when keratic precipitates appear in the fellow eye (3) in cases in which there is no hope that the eye will ever again be serviceable and (4) when endophthalmitis is present.

The eye should not be enucleated (1) when the wound heals properly the tension is good, sight is retained, and the fellow eye shows no irritation (2) when the injured eye still has some vision after the fellow eye has become severely inflamed (3) when both eyes are violently inflamed and (4) when panophthalmitis is present. Enucleation should be postponed until the inflammation has subsided.

Iridectomy for relief of secondary glaucoma should be avoided. Paracentesis is the sole operation that is permissible.

A complicated cataract which develops in the sympathizing eye should not be removed for many months.

With regard to medical treatment, it is pointed out that miotics may increase the central synchia, and mydriatics may produce glaucoma. Salicylates, mercury salvarsan, tuberculin sulfonamides, penicillin and fever therapy have been tried.

JOSEPH ZUCKERMAN, M.D.

**On Results Obtained by Total Conjunctival Hooding of the Cornea for Serpiginous Ulcer.** A. KETTER. *Bril. J. Ophth.*, 1948, 32, 36.

The author reports 56 cases of serpiginous ulcer treated by total hooding as compared to 119 cases in which the ulcers were medically treated, on the basis of visual acuity and hospitalization time.

The procedure is as follows. The bulbar conjunctiva was detached all around the limbus and was undermined into the upper fornix. The ulcerated parts of the cornea were scraped and the conjunctiva was anchored with catgut sutures in the episcleral tissue in a horizontal line 3 mm. below the cornea. Pain, lacrimation, irritation, and edema disappeared shortly after hooding. Removal of the hood was done not less than 6 months after the operation in order to prevent recurrence of the ulcer. Total hooding without prior medical treatment was recommended when vision was limited to hand movements or less, since it guarded against full visual loss. The number of improved cases and the improvement of vision were almost twice as great with the hooded method as compared to the medical treatment. Hospitalization time was cut nearly in half. This method has been extended by the author to all healed or poorly healing acute and chronic keratic processes, with good results.

ROBERT H. JOHNSON, M.D.

**Human Conjunctiva Grafted on the Chorioallantois of Chick Embryos.** A. FETTERDAKE and W. KORNBLUTH. *Arch. Ophth.*, Chic., 1948, 39: 67.

The authors report the grafting of human conjunctiva on the chorioallantois of chick embryos. An oval piece of conjunctiva was removed from the

lower fornix of the human being and transferred to an isotonic solution of sodium chloride containing penicillin. Fertile hens eggs incubated for a period of 8 to 12 days were used in the grafting experiments. After cleaning the egg with alcohol a one centimeter square window was cut in the shell. The shell was then perforated at the location of the air bubble with a sterile needle and the air aspirated. In this way the fibrous membrane was separated from the adherent chorioallantoic membrane of the shell which made it possible to cut the fibrous membrane without injuring the chorioallantois. A 2 mm. to 3 mm. square piece of conjunctiva was deposited on the chorioallantois at the site of the large membrane vessels. The shell window was framed with paraffin and sealed with a cover glass. The needle hole was sealed and the egg was then incubated at 38 degrees centigrade. Twenty four hours later 300 units of penicillin were instilled on the chorioallantoic membrane near the graft. This was repeated 48 hours later. After a period of 6 days the experiments were concluded and the graft together with the adherent chorioallantoic membrane was removed and then stained.

At the end of the 6 day period of incubation the conjunctival graft was pinkish in color and was adherent to the chorioallantoic membrane the vessels of which were widened and more numerous. Microscopic examination showed that the epithelial cover of the transplanted conjunctiva varied in thickness but was usually thinner than normal. The cellular architecture was usually altered. The arrangement in layers was not always clearly discernible and the regular position of the nuclei was disturbed. The individual epithelial cells fairly constantly presented a normal appearance and were usually well demarcated. There was no distinct division between the epithelium and the subepithelial tissue. Groups of epithelial cells seemed to penetrate deeply into the subepithelial tissue at the border. Frequently the epithelial cover was infiltrated with chick polymorphonuclear leucocytes. Mitotic figures were noted in all layers of the conjunctival epithelium.

The subepithelial tissue was usually well preserved the number of mononuclear cells was not increased and the stroma contained a dense meshwork of collagen fibers. In many grafts a scanty infiltration of polymorphonuclear leucocytes was observed the cells accumulating mainly at the border between the epithelium and the subepithelial tissue. Occasionally small sharply delimited necrotic areas were encountered within the subepithelial tissue. The grafts showed an abundance of wide capillaries which arose from the chorioallantois and penetrated the graft. The capillaries were lined with flat and cuboidal cells and engorged with nucleated chick red blood cells. Occasionally human red blood cells were seen. The chorioallantoic membrane lost its ectodermal cover where the graft became adherent but the ectoderm and the conjunctiva each maintained their own character. Only rarely were necrotic areas seen in the chorioallantoic membrane.

These experiments showed that it is possible to maintain fairly healthy human conjunctiva outside of the body without substantial alteration. Survival of the transplant is due to the fact that the graft is quickly incorporated into the vascular system of the chorioallantois. The vascular system of the conjunctiva probably becomes connected with that of the chick embryo. The pathological feature noted most frequently in the conjunctival graft was the infiltration of the polymorphonuclear leucocytes which originate in the chick embryo. This is probably a response of the host to a foreign tissue and apparently does not interfere with the survival of the graft. Two reasons for unsuccessful grafts were infection and a tendency of some grafts to sink into the mesoderm. ROGER H. JOHNSON, M.D.

#### Transplantation of Vitreous. A Preliminary Report HERBERT M. KATZ and JOHN BLUM. *Brit J Ophth* 1947 31 360.

The authors conclude from their experiments on rabbit that transplantation of vitreous material leads to complications. At a later date they expect to amplify this report by experiments with human material. Several methods of transfer of vitreous were employed in 39 eyes.

Transplantation of vitreous was complicated by retinal detachment and cataract formation. Detachments of the retina in rabbits usually heal spontaneously, however a few did not heal. Cataracts resulted from injury during the operation. There were no cases of chronic uveitis.

Transplantation of the vitreous was found to be more successful than replacement with saline solution because the eye metabolizes the injected vitreous and accepts it into its own structure.

Of 39 rabbit eyes followed up for a period of 6 months, 6 developed detachment of the retina, 2 developed traumatic cataracts and 7 presented a localized fibrous tissue proliferation around the puncture site.

These possible complications should be borne in mind when transfer of vitreous is considered as a clinical procedure. JOSEPH ZUCKERMAN, M.D.

#### Peripheral and Central Disturbances of the Visual Fields. An Aspect of Ophthalmology. N. A. STRETTWITZ. *Brit J Ophth* 1947 31 31.

The author discusses some peculiar disturbances of the peripheral and central fields of vision. He presents 3 cases which he believes represent a form of disturbance of the peripheral vision or of central vision or both which does not have an organic or functional basis but is a disturbance of kinetic factors as revealed by the study of the history and its correlate convergence. He states that this condition is not yet recognized in ophthalmology as a clinical entity. He is of the opinion that kinetic treatment, which affects adduction abduction and lateral fusion can effectively cure limitation of the peripheral field and failure of the central field of vision. JOSEPH ZUCKERMAN, M.D.

## A Case of Metastatic Osteosarcoma in the Choroid.

V T LUNA. *Brit J Ophth.*, 1947 3 713.

Metastasis to the eye is extremely rare. The author reports a case of osteosarcoma of the choroid which metastasized from a primary growth in the chest. Metastasis was presumed to have extended from an erosion in the carotid artery. The condition began with a sarcoma of the knee following injury. After amputation metastases appeared in the chest. When the eye was first examined a patch of scleral hyperemia was present in the lower nasal area, the anterior chamber was shallow, the pupil was dilated and did not react to direct light, but did react consensually. The tumor was examined biomicroscopically. There were two nodules, one extending from the disc to the equator and the other from the equator forward. There was no visible pigmentation. The solid nature of the nodules was demonstrated by transillumination.

Later the detachment became total so that the tumor was no longer visible. Postmortem examination of sections of the eye revealed osteosarcoma which formed irregular trabeculae of osteoid tissue. The centers of a few trabeculae presented calcifications, but the bulk of the tissue was noncalcified. The tumor was a sarcoma which originated from bone.

The bone sarcoma in the knee had evidently spread to the mediastinum and from there to the eye by vessel erosion. The presence of a double tumor in the eye was suggestive of its metastatic origin. The sections showed the distinctive cell pattern of bone sarcoma.

Cases have been reported previously in which metastases occurred in the second and third nerves in the cranium, and in the second nerve and in the muscles within the orbit. Both eyes were affected by deposits in the choroid.

A similar case was described by Weiner (1903) and by Ballantyne (1903) following primary sarcoma of the chest. In both cases metastases occurred in the suprarenal gland, and in the brain with deposits in the optic nerve extending from the disc to the retina. Heine (1890) described a metastatic sarcoma of the optic papilla. Schless, Gemmuse and Rogh (1879) described a pigmented tumor of the disc which extended from a malignant melanoma of the skin. Neese (1907) reported a choroidal tumor which metastasized from a sarcoma of the breast and Elschnig (1926) reported a tumor of the iris originating from a primary lesion of the ovary.

JOSHUA ZUCKERMAN M D

Intramural Vascular System (Vasa Vasorum?) in Retinal Vessels. ARNOLD LOWENSTEIN. *Arch. Ophth.*, Chic., 1948, 39 9.

Vessels within the wall of retinal vessels have not hitherto been recognized. In general, only the walls of vessels with a caliber greater than one millimeter are provided with vasa vasorum which arise from adjacent small arteries and form a dense capillary network in the adventitia. It has been shown that an intramural vascular system exists in the sclerosed

aorta and in sclerosed coronary vessels. Here a rich vascular system has been found in the intima and within and around the arteriosclerotic plaques. In arteriosclerotic coronary arteries, intramural vessels arise from the lumen of the partly occluded vessel. A similar system was also found in the veins. This is not found in healthy vascular walls in young people. The author has observed single capillaries running within the hyaline thickened wall of sclerosed retinal vessels. The walls are extremely thin and difficult to see. The majority of intramural vessels run parallel to the lumen though they also run obliquely and in a circular course. They are more frequently found at points of bifurcation and, on serial sections, are seen to open into the lumen. Frequently the site of origin of intramural vessels in the intima was surrounded by a group of endothelial nuclei. The author was able to follow the intramural vessels, which are predominately capillaries, from their lumens in the retinal vessels into the hyaline coat and to demonstrate union with sister branches and the adjacent retinal vessels. This condition is never observed in normal retinal twigs. He found newly formed intramural vessels both in hyalinated arteriosclerotic vessels and in a case of subendothelial fatty necrosis, a typical atheroma. A large number of intramural capillaries were found in a patient with thrombosis of the central retinal vein. In vasculitis retinae, some regular capillaries were conspicuous and sharply delineated. In other places a far more irregular system of capillary channels had replaced the main vessel. These vessels contained a multitude of endothelium-lined lumens separated by a nucleated granular substance.

The intramural vessels, for the greater part of their course, remain within the hyalinized wall whether they run parallel to the lumen, in circles, or in spirals. They serve the nutrition of the diseased tissue. The metabolism of the normal wall of the small retinal vessels is maintained by the blood stream in the lumen, the diseased vessel wall, the hyaline thickened coat especially demands more nutrition. The changed consistency of the tissue may act as an impediment to the movement of fluid. It is likely that oxygen tension and lack of nutrition are responsible for the stimulation of the formation of additional blood vessels. Since these intramural capillaries are made up of a simple endothelial layer and since they connect directly with the lumen of the vessel their intracapillary pressure is higher and they rupture more easily. The intramural vessels may serve to transport blood over an occluded or narrow part of the lumen.

ROGER H JOHNSON M D

The Blood Supply of the Optic Nerve. DERRICK VAIL. *Am. J. Ophth.*, 1948 3 1.

The purpose of this paper is to review the anatomy of the optic nerve and its blood supply and to consider a few lesions in this regard. The gross anatomy of the optic nerve and chiasm are considered and their relationship to the surrounding structures

within the brain and throughout the course of the optic nerve are discussed in detail. The chiasmal portion of the basal cistern which continues along the optic nerve toward the globe is reviewed.

The author believes that there is a separation between the intervascular space and the perivascular connective tissue of the central vessels where they enter the optic nerve. The blood to the intracranial portion of the optic nerve is supplied chiefly by minute branches from the internal carotid artery and sometimes by the ophthalmic artery below and superiorly by the anterior cerebral and anterior communicating arteries. The intracranial portion is supplied by pial vessels arising from the internal carotid and anastomoses with septal vessels from the orbital and intracranial portions of the nerve. The orbital portion is supplied by vessels that pierce the dura behind the entrance of the central vessels and those that join the pial network anteriorly at the site of the entry of the central vessels. The upper and lateral portion of the periphery of the nerve is supplied by branches of the ophthalmic artery the posterior ciliary arteries and recurrent or collateral branches from the central artery. The central portion of the nerve is supplied by branches from the central collateral artery and occasionally by a posterior axial branch from the central artery. The central artery usually comes from the ophthalmic, the long internal ciliary the external ciliary or the short posterior ciliary arteries. Where it enters the dura it gives off branches which go backward and forward and join the pial network to send branches to the optic nerve. Other branches from this network are sent to the lamina cribrosa and backward through the center of the optic nerve. The central retinal vein has numerous anastomoses near the papilla. After it leaves the nerve it becomes the venous network in the orbital fat and empties into the cavernous sinus, the superior orbital vein the inferior ophthalmic vein or several combinations. The posterior central vein of the optic nerve collects blood from the orbital portion of the nerve and empties into the cavernous sinus.

The author correlates various details of the anatomy with clinical pictures that could be based on anatomical changes. ROGER H. JOHNSON M.D.

## EAR

**Escape of Cerebrospinal Fluid Into the Wounds of Operations on the Temporal Bone** H. I. LILLIE and ARTHUR A. SPAR. *Arch. Otolaryng.* 1947 46 779.

An injury to the dura which permits the escape of cerebrospinal fluid into the wound during the course of an operation on the mastoid might seem alarming because of the serious implications of impending meningitis. However the experiences reported seem to indicate that the difficulties may be overcome by surgical methods.

A review of the available literature pertaining to postoperative cerebrospinal otorrhea is given. The

factors involved in the origin of a cerebrospinal fistula are described and means of preventing the formation of a permanent cerebrospinal fistula are discussed. Methods which have been found successful in 4 cases for repair of dural defects of various sizes are described.

It would appear obvious that should an injury to the dura, which permits the escape of cerebrospinal fluid occur during an operation on the mastoid process it should be closed immediately rather than at a subsequent operation.

In case the escape of cerebrospinal fluid occurs as the result of the dislocation of the stapes, the precedent established is that any surgical interference be deferred because the escape of the fluid is usually controlled by natural reparative processes.

While it actually seems that when cerebrospinal fluid escapes into the mastoid wound the wound apparently clears of evidence of infection rapidly such a phenomenon should not be relied on to take place.

The present-day prophylactic use of penicillin and chemotherapeutic drugs is extremely beneficial and results are reassuring. These drugs are administered preoperatively and postoperatively. They were not available for use except in recently encountered cases.

## NOSE AND SINUSES

**Diseases of the Maxillary Sinuses Resulting from Pathologic Changes.** KURT H. THOMA. *J. Oral Surg.* 1947 5 271.

The maxillary sinus can become involved by a large variety of pathologic entities derived from the teeth or from diseases of the maxillary bones.

Hematomas from rupture of the infraorbital and superior alveolar arteries as a result of fractures may continue to bleed as evidenced by pulsating pressure and repeated epistaxis. Surgery may be required. Infection of course adds to the gravity of the situation.

Odontogenic maxillary sinusitis usually results from periapical infection often in conjunction with excessive trauma incident to exodontia or other surgical procedures. When the process is acute the antrum may be entirely obliterated by the edematous and infiltrated lining and the presence of a mucoid or purulent exudate. Inadequate drainage leads to constitutional as well as local manifestations. The diagnosis is apparent from careful physical examination alone as a rule. Chronic infections however are more insidious in onset and the findings are frequently circumscribed initially. Later localized abscesses cysts or polypi or both may supervene and involve the antrum generally. Transillumination and roentgenography often aid in determining the cause as well as the extent of the infection.

Odontogenic cysts of the maxillary sinus are either radicular or less commonly dentigerous. Globulomaxillary cysts from the embryonic fissure between the lateral incisor and cuspid may similarly en-



that the foramen lacerum and the eustachian tube allow an easy gateway to the region of the petrous tip probably accounts for the high incidence of involvement of the fifth nerve and the nerves to the extraocular muscles. The cervical sympathetic supply to the eye may be interrupted either here or in the neck by cervical metastases. Pressure on nerves with resulting irritation and ablation phenomena easily explains all of the symptoms noted in the appropriate distribution of the involved cranial nerves. In one instance actual invasion of the temporal lobe took place with a resulting aphasia.

A. B. VICARIO, M D

## MOUTH

**Dominant Inheritance of Cleft Lip and Palate in Five Generations.** AVERY R. TEST and HAROLD F. FALLS. *J Oral Surg.*, 1947 5 292.

The authors study concerns a pedigree of cheilognathouranoschisis complex extending back for five generations. The complex as a whole was found to demonstrate the typical pattern of dominant mendelian inheritance. The degree of dominance varied greatly among affected persons as did the expressions of the various aspects of the complex. The gene, however exhibited sufficient dominance to fulfill the requisites of dominant inheritance of an irregular type. There was no evidence of sex linkage, sex limitation or sex influence nor was there any evidence in favor of the often expressed idea of greater frequency among males.

A marked variation in degree of expression of the gene was present. Singly or in combination these anomalies indicate that the affected person no matter how mildly involved is capable of transmitting the trait in either severe or mild form to approximately half of his or her offspring. The authors, therefore believe that the severity of the trait in a parent is no indication of the severity which may be expected in the offspring.

This phenomenon of variable expression of a gene especially prevalent in the syndrome under discussion, is rather common in human heredity and unless all living members of a family are carefully examined for aborted forms of the complex in question, the typical mendelian inheritance pattern may not be apparent.

Attention was also called to the fact that the very rare human anomaly of accessory salivary glands of the lower lip may be an expression of the cheilognathouranoschisis complex. This association was described by Strauth and Patton in 1943. The authors also clearly show that this defect imposes socioeconomic handicaps which depend upon the severity of the disfigurement. DAVID H. LYNN, M D

**Palliative Procedures in Advanced Cancer of the Mouth.** GRANT BICKERTAND. *Radiology* 1948, 50 10.

Under the designation of cancer of the mouth are included those malignant neoplasms occurring on the

vermillion portion (mucosa) of the lips, the buccal mucosa, gingivae, tongue (except for the base), the floor of the mouth, hard and soft palates, and anterior tonsillar pillars. Cancers of the tonsil, pharynx, and base of the tongue (all pharyngeal structures) will also be considered because of the continuity of structures with the buccal cavity and the similar problems which arise in the management of growth at these sites. Advanced cancers of the mouth and pharynx may be limited to a single anatomical structure or may involve several adjacent or distant parts of the body. Cancer of the lip may be advanced locally but still remain limited to the primary site or again it may extend to the corners of the mouth, the buccal mucosa, the gingival buccal gutter or lower jaw and yet not metastasize to the neck. Since the majority of lesions involve the muscularis of the lip, such neoplasms will eventually reach the neck nodes by way of the abundant lymphatic channels of that structure. Advanced cancers of the buccal mucosa may also extend to the upper or lower jaw and will frequently show cervical metastases.

With cancer of the gums there may be considerable destruction of the jaw bone either from the disease itself or from radionecrosis if portions of bone have been exposed to vigorous radiation therapy. The buccal mucosa, floor of the mouth, tongue, anterior tonsillar pillars, and lymph nodes of the neck may be involved either by direct extension or by way of the lymph vessels. Cancer of the tongue, while usually arising from the margins or base, may involve a large portion of that organ, the floor of the mouth, the tonsillar pillars, and the pharyngeal wall in most instances. In the advanced stage it will also show neck node metastases. Advanced cancers of the soft palate and tonsils of epithelial or lymphoepithelial origin are of a higher degree of malignancy than most cancers of the mouth and, therefore, besides direct extension to neighboring tissues such as the tonsillar pillars, floor of the mouth, base of the tongue, pharyngeal wall and extrinsic larynx, they almost invariably show neck metastases.

Most advanced intraoral cancers thus involve besides the site of origin the adjacent structures or the lymph nodes of the neck or both. Therapeutically both the primary focus and the secondary nodes must be considered carefully from a surgical and radiological point of view to obtain the highest rate of cure and the greatest degree of palliation.

The most common symptom is pain which may have been present for weeks or months depending on the location and extent of the primary disease, the amount of infection present, and the degree of the metastatic involvement of the cervical lymph nodes. In cancer of the lip and of the anterior two-thirds of the mouth and in most adenocarcinomas pain usually appears late. It is limited first to the regional area, then extends along the lower jawbone, and eventually to the ear, neck, and side of the head, unilateral in the beginning but finally bilateral as the whole lip, the jawbone, and neck nodes are involved. In squamous cell carcinomas of the posterior third of



the mouth and pharynx, pain in the ear due to ulceration and infection is the early complaint. Later the pain increases in severity and is constant along the jaw and side of the head, involving both sides when the cancer has crossed the midline. Neck and shoulder pain appear as the metastatic nodes become large and fixed.

Tumor occurs due to ulceration and infection in the mouth or throat or cellulitis in the neck and mandibulo-temporal region. Lumps in the mouth or throat are often the first manifestations of adenocarcinomas and mixed tumors usually they are found in the buccal mucosa, soft palate or tonsillar regions. Growing slowly the tumor may attain large dimensions and may form a mechanical barrier to swallowing and talking before ulceration and infection occur.

Severe dysphagia with extreme loss of weight and strength is common with ulcerations of the mouth and throat and may extend to the hypopharynx or extrinsic larynx, and even to the esophageal opening. When the arytenoids and aryepiglottic folds become edematous, either from the disease or from secondary infection or radionecrosis, dyspnea and stridor may become evident. Bad taste and foul breath are associated with necrotic lesion. Bleeding from infected deep ulcers may terminate in anemia from long continued oozing or massive hemorrhage.

Lumps in the neck are often the earliest symptom especially in cancers of the posterior third of the mouth, tonsil and pharynx. They are painless at first but later become enlarged and fixed with pain and stiffness of the neck and shoulder in many cases ulceration, continuous between the mouth and neck occurs. Half of the face becomes a large oozing drooling bleeding granular necrotic, foul-smelling ulcerated mass and the terminal course is protracted painful and pathetic.

A biopsy from the margin of the growth or an aspiration of the palpable nodes may be done without fear of crossing the normal neck barriers or of complicating the case should a radical neck dissection be decided upon. A pre-biopsy should be avoided.

The majority of advanced cancers of the mouth are incurable. Highly malignant cancers of the posterior third of the mouth and pharynx are not readily amenable to surgery but fortunately they are radio-sensitive and fractional radiation gives fair results. Neck metastases are likely to be early and wide spread or even bilateral and respond more favorably to irradiation. Most bulky cancers of the lip with or without neck metastases are difficult to control by radiation therapy. Good results have followed wide excision of the primary lesion with plastic repair combined with radical neck dissection when the cervical nodes are involved. Radical resection of the lip, jaw, tongue, floor of the mouth or buccal mucosa with radical neck dissection is curative in many cancers which previously were regarded as inevitably fatal. The majority of these tumors grow slowly, metastases are often limited to the upper half of the neck and are not amenable to radiation therapy.

Fixation of the mandible is no longer considered a sign of incurability. For adenocarcinomas and mixed tumors surgical removal is the procedure of choice, both for the primary growth and the nodes in the neck.

In patients with highly malignant cancers of the posterior third of the mouth and pharynx, in whom an attempt at cure is justifiable, daily doses of 200 to 300 roentgens (in air) for a total of 4,000 to 6,000 roentgens per portal should be used. Smaller doses at longer intervals are used only as a palliative measure. For metastases to the neck nodes, roentgen therapy is the treatment of choice. Too large portals extending beyond the margins of the tumor are ineffective. Roentgen therapy in moderate doses is frequently of value in cleaning up infection and may make surgical intervention safer in many primary lesions. It may also be of value in certain cases of neck metastases preliminary to neck dissection. Gold seeds of radium implanted in the nodes combined with surgical removal or irradiation of the primary cancer, may be the procedure of choice for the aged and the weak. Recurrent cancers after surgical intervention call for palliative small doses of roentgen rays.

The palliative care of the patient with advanced cancer of the mouth is the obligation of the surgeon in those cases in which surgery is the treatment of choice. The task of the radiologist is not complete with the administration of roentgen rays and radium, but includes repeated examination, daily removal of slough, frequent packing of ulcers, institution of a proper dietary regime, relief of radiation reactions, and whatever contributes to the control of infection and the alleviation of the patient's suffering.

A. B. FICKEN, M.D.

## NECK

**Effects of Vitamin A Deficiency on Thyroid Function Studied with Radioactive Iodine.** MORTON B. LIPSETT and RICHARD J. W. ALLEN. *Endocrinology* 94:7-4, 1949.

Prompted by the lack of agreement concerning the effects of vitamin A deficiency on the thyroid function, the authors conducted an investigation of thyroid function in severe avitaminosis. Radioactive iodine was used as a tracer.

The parents of the animals used in the experiment were maintained for a period of at least 2 months previous to breeding and for 14 days after birth on Sherman diet B without added lettuce or meat. On the fourteenth day mothers and litters were placed on a vitamin A-low diet. At 21 days the animals were divided into three groups: one with a deficient diet, one control group injected with 8 international units of vitamin A daily, and the third group with 20 mgm. of carotene per kilogram daily. The animals were injected intraperitoneally with a tracer dose of about 50 microcuries of  $^{131}\text{I}$ . The separation of iodine fractions was after the method of Perlman, Morton and Chalkoff. For determinations of total iodine, diiodotyrosine, iodine and thyroxine iodine

aliquots were digested and distilled according to the procedure of Taurog and Chalkoff

The experiment indicated that in avitaminosis A there is a decreased rate of formation of thyroxine. The glands of the rat were relatively heavier in the A-deficient group. The histological picture of A avitaminosis appeared as degenerative changes and distended thyroid follicles both present concomitantly. The total  $I^{131}$  uptake was not changed the inorganic  $I^{131}$  in the thyroid reached higher than normal values and decreased more slowly than in the controls

W FOSTER MONTGOMERY M D

**Treatment of Graves Disease with Radioactive Iodine.** MATO H. SOLEY and EARL R. MILLER.  
*Med Clin N America* 1948 32 3.

Radioactive iodine was first used in the treatment of thyrotoxicosis by Hertz in 1941. Hamilton Soley and Eichorn, Hertz and Roberts, and Chapman and Evans have done much of the fundamental work with this agent.

The authors injected 300 microcuries of carrier free radioiodine,  $I^{131}$  subcutaneously in rabbits and dogs. They found extensive necrosis hemorrhage polymorphonuclear infiltration and arterial changes in the thyroid at 10 days. After this time the fibrosis gradually increased.

A careful description of the technique of standardization and calibration method of administration measurement of activity and method of handling  $I^{131}$  is given. The uptake of iodine in normals is usually much less than 30 per cent. In frank untreated Graves disease it is usually between 40 and 80 per cent therefore the use of tracer doses (100 to 250 microcuries) is of diagnostic value. In the dose range the number of iodine molecules is so small that no effect due to iodine is expected.

Thirty three patients with Graves disease were treated by orally administered radioiodine ( $I^{131}$ ) and have been followed for a period of 3 months to 2 years. No nodular goiters were included since it is believed that these should be treated surgically. The smallest dose of  $I^{131}$  which produced a satisfactory remission was 800 microcuries the largest dose 9,150 microcuries. The authors recommend a schedule including an initial dose of 2,000 microcuries with repetition of similar doses at monthly intervals until the required total dose is given.

Twenty five of the patients in the series (75%) had satisfactory remission of symptoms and signs of hyperthyroidism in 1½ to 7½ months following the beginning of therapy. The average time was from 3 to 7 months. The results in the remaining 8 patients have been classed as unsatisfactory. These patients have either taken too long to return to normal or have not returned to normal within a year after treatment was started.

Careful studies were made of the change in estimated thyroid weight, basal metabolic rate, protein bound iodine, uptake of  $I^{131}$  in the thyroid and estimated time from the initial dose of  $I^{131}$  to return to normal

In the successfully treated patients the weight of the thyroids decreased from an average of 30 gm to less than 15 gm the basal metabolic rate dropped from an average of plus 30 to minus 20. The protein bound iodine dropped from an average of 10.6 to 5.7 micrograms per 100 cubic centimeters. The average total dose of  $I^{131}$  was 2,726 microcuries.

In the unsuccessful group the goiters were larger the basal metabolic rates higher and the protein bound iodine was higher. It is believed these sicker patients were not given adequate doses. They probably needed from 10 to 12 millicuries.

Within from 24 to 72 hours after the administration of  $I^{131}$  the thyroid becomes tender, the sedimentation rate is increased and the protein bound iodines are increased. The symptoms of hyperthyroidism from the fourth to the tenth day seem to be increased. Changes in exophthalmos after  $I^{131}$  therapy were not significant.

$I^{131}$  has a half life of 8 days and 1 microcurie distributed through 1 gm of tissue gives 142 equivalent roentgens of beta ray energy during the course of its complete decay. Other clinics are using much larger doses than those used by the authors. As yet no one knows whether a single dose of 12 millicuries is more effective than 6 doses of 2 millicuries.

Studies of dosage problems, measurement of radioiodine and distribution of iodine in the thyroid indicate that further experience is necessary before conclusions can be drawn as to the place of this type of therapy in Graves disease.

ROBERT R BIGELOW M D

**Experimental Chronic Thyrotoxicosis in Guinea Pigs.** The Hematopoietic System Liver Spleen and Endocrine Glands (La thyrotoxicose expérimentale chronique du cobaye. Le système hématopoïétique, le fode la rate et les glandes endocrines) F LAYANI, A. ASCHKENASY and J. MIGNOT  
*Ann endocr* Par 1947 8 205

The authors reproduced hyperthyroidism in immature female guinea pigs by the administration of powdered thyroid and made the following observations

1 Chronic thyrotoxicosis is accompanied by an increase in leucocytes polymorphonuclear cells, and eosinophils. The bone marrow becomes hyperplastic but the hemoglobin does not vary. This myelotropic action of the thyroid differs from that of the liver or hepatic extracts which are both cytopoietic and hemoglobinopoietic.

2 There is a functional inhibition of the thyroid gland characterized by a loss of small acini an increase in the amount and age of the colloid and a flattening of the acinar epithelium.

3 A hyperplasia of the adrenal cortex is found to occur

4 There is a moderate hypertrophy of the spleen with reticular reaction but without lymphoid hyperplasia

5 There are no histologic alterations of the liver

EDWARD W GIBBS M D

**Experimental Chronic Thyrotoxicosis in Guinea Pigs. The Osseous System** (La thyrotoxicose expérimentale chronique du cobaye. Le système osseux.) F. LAYAT, J. MIGNOT, M. CHAMPEAU and A. ARCHEKIAN. *A. n. endocr.* Par. 1947 8: 37.

Prolonged intrasosseous administration of weak doses of powdered thyroid to guinea pigs produced certain bony changes. Radiologically there was a rarefaction of the femurs with a disturbance of the arrangement of the bony lamellae at the borders of the femoral head and trochanters. Histologically there was a diminution of phosphorus and calcium around the edge of the bone, a disappearance of the spongy diaphysis and a thickening of the cortex. No osteoclastic activity was observed.

The bone marrow showed evidence of hyperactivity which is in accordance with the hematopoietic activity of the thyroid. There was no consistent change in the serum calcium, phosphorus, or phosphatase. No findings were similar to those of parathyroid osteosis. EDWARD W. GIBBS, M.D.

**The Mortality of Thyroidectomy** (Mortalit  t der Strumektomie) M. RICHARD. *Deutschr. chir. acts*, 1947 4: 306.

The author reports a mortality of 0.34 per cent in 3,340 thyroidectomies (13 deaths) from 1931 to 1947.

The series includes all operations on the thyroid gland for nontoxic, toxic Basedow's, malignant, inflammatory and recurrent goiters. The 13 fatal cases were classified as nontoxic goiters (6), toxic goiters (6) and Basedow's disease (1). There were no fatalities in the recurrent, malignant, or inflammatory groups. No deaths occurred as a result of hemorrhage, wound infection, myxedema, or of tetany.

The causes of death were cardiac insufficiency (1), air embolism (1), pneumonia (1) and postoperative toxic crisis (9). Postmortem examinations showed that of the 9 cases of so-called postoperative toxic crisis there were only 2 in which no pathologic anatomic changes could be found to account for death. In the remaining cases the postmortem examination revealed 2 instances of persistent thymus, 2 of suffocation from laryngeal edema with bloody infiltration of the mediastinum, 2 of toxic coma with bloody mediastinal infiltration and 1 instance of lung carcinoma. The author believes that in many cases of postoperative crisis, and especially when it occurs in nontoxic goiter, there is a hemotoxic histamine-like substance which damages the autonomic cardiac nerves and ganglia and accounts for the bloody mediastinal infiltration.

JOHN L. LINDQUIST, M.D.

# SURGERY OF THE NERVOUS SYSTEM

## BRAIN AND ITS COVERINGS CRANIAL NERVES

**Cerebral Angiography with Ioduron (Angiografia cerebrale con ioduron)** MARINO QUARTI TREVANO  
*Chirurgia*, 1947 2 157

The new shadow producing preparation which has recently come on the market is a stable water soluble salt containing 55 per cent of iodine combined as a diiodate of pyridone. It can be injected in 30 per cent solution, and it is much more fluid than thorotrast. No damaging effects have been reported from its use. Following injections into experimental animals no free iodine was excreted through the kidneys. The author has now completed 100 angiographies using this preparation by percutaneous injection into the internal carotid artery. At least 2 injections were made in each subject studied and in a few instances as many as 4 injections were practiced at one sitting. The minimum amount for one injection has been 7 c.c. and the maximum 14 c.c. with a total amount not exceeding 40 c.c.

The patient partially stupefied by oral and intravenous drugs, is placed supine with head extended and the needle is entered over the pulsating artery just below the upper border of the thyroid cartilage. If the oscillations of the needle upon reaching the artery are not perfectly vertical it is considered that the needle has struck the vessel tangentially and the instrument is withdrawn and reinserted at another point. The ioduron is injected rapidly into the artery as soon as the roentgenologist gives the ready signal. The arteriogram is taken during the process of injection (after 6-6 c.c. have been injected) and the phlebogram exposure is made 2 seconds later.

In the use of this substance by this method in a wide variety of intracranial and intracerebral conditions, the author has seen no bad effects nor has there developed any hematoma or other evidence of harm to the injected artery. Some of the patients complain of facial pain during the injection, however with a co-operative spirit and enough of the drug any incidental discomfort is always tolerated tranquilly. The greater portion of the article is taken up with the production of photographs portraying the wide variety of intracranial conditions demonstrated by this method.

JOHN W. BRENNAN M.D.

**Penetrating Wounds of the Cerebral Ventricles.**  
HENRY G. SCHWARTZ and GEORGE E. ROULHAC.  
*Ann. Surg.* 1948 127 58.

The author reports an analysis of 50 consecutive cases of head injury with penetrating wounds of the cerebral ventricles. There was a 30 per cent mortality (15 cases) which could be assigned to two factors: infection (60%) and vital brain damage (40%). These cases were verified either at the time of surgery by direct vision or at autopsy.

Thirteen patients were operated upon primarily at an average time of 39 hours after injury. The 4 deaths in this series were all due to vital brain damage. Although infection developed in 2 cases the condition cleared up with adequate surgery. Thirty six patients were operated upon at forward installations at an average time interval of 15 hours. Thirty one of these required further surgery—for abscesses in 12 patients, meningitis in 3, and ventriculitis and meningitis in 14. Of the 10 deaths in this series 9 occurred as the result of infection.

The three main factors which enter into the higher mortality of penetrating wounds of the cerebral ventricles are as follows:

1. Introduction of infection with resultant ventriculitis. Incomplete débridement is probably the most important fault.

2. Hemorrhage into the ventricular system. This was not a common finding in the series, however when present it is necessary to remove the clot under direct vision and to verify hemostasis.

3. Injury to vital centers. This group is not amenable to surgical therapy.

Although the treatment is not different from that used in other types of cerebral wounds, it is emphasized that adequate aggressive débridement of the entire tract, including the ventricles, be performed under direct vision. This applies also to secondary cases with abscess or ventriculitis. Chemotherapy and antibiotic therapy was used in various combinations in all cases but they are effective only when combined with the necessary surgery.

JACK I. WOOLF M.D.

**The Treatment of Open and Closed Craniocerebral Injuries (Le traitement des traumatismes crâniocérébraux ouverts et fermés)** WILLIAM JUNKER  
*Helv. chir. acta* 1947 14 274.

This article from the surgical clinic of the University of Geneva represents the views of the majority of neurological surgeons on head injuries. It is more an abstract of the literature than an experience of the author. As he states the cases are limited but they have been well followed up. There are a few case reports to illustrate the problem and the discussion.

The author discusses briefly and concisely all forms of open and closed head injuries and mentions the opinions of various authorities on these matters. He states that he has considerable difficulty in understanding the conception of concussion or commotio cerebri but declares that of 1,055 cases of head injuries observed at the Clinic for a period of 10 years 527 were commotio cerebri with cure in 87 per cent. Contusion of the brain is discussed with reference to the fact that there is a 10 per cent margin of safety for the brain within the cranial cavity. If the intracerebral contents expand beyond 10 per

cent serious compression will occur because the brain is anchored within the cranial cavity. The 10 per cent augmentation of the volume of the brain interferes with venous drainage with a hypersecretion of spinal fluid which then becomes a vicious circle. Of the 1,033 cases 339 were contusions with cures in 61 per cent and a mortality of 8.6 per cent. Among the suggestions made in the discussion of contusions is that of removing the contused tissue by operation. However the author goes on to say that edema is probably the most important factor. The semisitting position is stressed in the treatment of these cases. The question of extradural hemorrhage is discussed briefly and arteriography is suggested for localization of intercranial hematomas. Mention is made of acute external hydrocephalus.

Open wounds of the brain are mentioned and the conclusions reached with regard to treatment differed very little from those that are commonly now accepted in this country. The skin must be closed over the defect at all costs, with a local application of sulfanilamides and penicillin in cases of primary closure. It is pointed out that it is more important to take the patient to centers where there is special equipment than to turn a general hospital into an ineffective and modified neurosurgical clearing station. The experiences of the British in this matter are discussed. Apparently in Switzerland they are less disturbed when penicillin passes the spinal fluid barrier than we are in this country. The question of dealing with fractures through the accessory sinuses is discussed and apparently operation has not been required in the cases seen at this clinic. Finally the postoperative care of the patient is mentioned with reference to the time at which he should become ambulatory. There seems to be a tendency to keep the patient in bed from 12 to 25 days. The rehabilitation of head injuries is emphasized for it is believed that a useful person should be returned to society not an invalid. The bibliography especially with reference to European authors, is extensive.

ADRIEN VAN BRUGGEN, M.D.

**Cerebral Granuloma.** TUNO-HO CHAWO, GEORGE W. SMITH, F. REGIS REIDEMAN and EDWIN F. ALSTON. *J Am Med Ass* 948, 136. 30.

The authors present 4 cases of cerebral granuloma caused by *Schistosoma japonicum* eggs which were verified at operation. All patients presented similar neurologic signs and symptoms which pointed to an intracranial space-occupying lesion. In 3 of the patients the granuloma was located in the left hemisphere and produced right-sided hemiparesis, Jacksonian convulsions, and speech disturbances. Only one patient showed obvious signs of increased intracranial pressure. Air studies confirmed the diagnosis of intracranial tumor in each case. In 2 of the patients a slight increase in the blood eosinophils (6 and 12%) was reported, together with a slight increase in the spinal fluid lymphocytes. The pathological examination of the tissue removed at operation

revealed numerous pseudotubercles which contained in their center nests of eggs of *Schistosoma japonicum* and giant cells. They were walled off by dense collagenous fibrous tissue and a zone of diffuse lymphocytic infiltration. The patients were given stibophen postoperatively and showed continuous but slow improvement in their condition.

These patients had all seen service in the South Pacific or the Philippine Islands, but none gave a history relative to an acute phase of schistosomiasis prior to the development of cerebral symptoms. The authors outline the life cycle of schistosoma, review their classification, and the differential diagnosis of their species on the basis of the appearance and size of the eggs and the geographical foci of infection. They discuss also the symptoms produced by the three clinical stages of infection in man. They believe that the cerebral symptoms are the result of the reaction produced by the deposit of eggs which reaches the brain after passing through the vertebral venous system or the accessory portal circulation.

The literature on cerebral schistosomiasis and its medical and surgical treatment is reviewed and the authors recommend craniotomy as an adjunct to the medical treatment when there is evidence of a localized expanding lesion. Cerebral schistosomiasis may appear clinically several months, or even several years, after the primary invasion by the larval form. The disease seems to be far more common than previously suspected. A history of early systemic schistosomiasis is not necessary for the diagnosis of the cerebral form which should be suspected if the patient has been exposed to the disease in regions in which it is endemic.

GEORGE PERRET, M.D.

**Contribution to the Study of Intracranial Cystic Neurinomas.** (Contributo allo studio dei neurinomi cistici intracraniali.) EUGENIO PATELLANI. *Chirurgia*, 947 2: 213.

A subdural cystic neurinoma of the spinal cord in a 39 year old woman was studied by the author histologically. The tumor was located at the level of the eleventh dorsal vertebra and produced an incomplete block of the subarachnoid space. The tumor was successfully removed and the patient recovered.

The tumor was encapsulated and highly vascular. In addition to fibrocellular areas there were fibrillary cells of immature character. From the histomorphologic point of view the dual composition of the tumor and the staining properties of the fibrillary portion justified the diagnosis of neurinoma of the Verocay Antoni type or neurofibroma or perineural fibroblastoma of the Mallory Penfield type. The mesenchymal histogenesis of the tumor could thus be established.

The formation of cavities or lacunae is ascribed by the author to edematous imbibition of the immature cellular formations caused by a sudden increase of pressure of the cerebrospinal fluid and also by necrosis of the intercystic septa. The last mentioned proc-

was conditioned by vascular disturbances probably was responsible for hemorrhages within the cavities.

A rapid increase of the size of the tumor undoubtedly was responsible for the neurologic syndrome of irritation and compression.

JOSEPH K. NARAT, M.D.

**The Treatment of Facial Paralysis by Tantalum Wire Suspension—Preliminary Report** LOUIS W. SCHULTZ and EDSON FAIRBROTHER FOWLER. *Plast Reconstr Surg.*, 1947, 5: 538.

A preliminary report of a modification of Schussler's tantalum wire suspension technique employing sheet tantalum saddle and the authors technique with tantalum gauze is presented as another addition to the surgery of facial paralysis and to the use of tantalum in plastic surgery.

Various methods employed in the surgical correction of facial paralysis by Busch, Momborg, Stein, Blair, Gillies, and Schussler with the use of wire of several varieties, fascia, and fascial slings are briefly reviewed with particular emphasis on the disadvantages of each in comparison to Schussler's method. The last technique has certain faults which the authors believe they have overcome with the use of tantalum gauze.

The surgical technique of an operation performed in two stages is described. In the first stage a pattern of tantalum gauze is set in the affected cheek and entirely across both lips. Fibrous bands growing through the gauze mesh firmly fix these parts. In about 2 months the second stage of the operation is performed. This consists of suspension, by means of tantalum wire of the tantalum gauze fibrous tissue. The wire is placed through the superior margin of the gauze in the cheek and connected with a tantalum gauze sheet fixed to the temporal fascia by tantalum wire. The postoperative care is described.

A series of 3 cases is presented with before and after pictures and one roentgenogram showing the tantalum gauze and wire in position postoperatively.

EARL H. KLABUNDE, M.D.

### SPINAL CORD AND ITS COVERINGS

**Pseudohypertrophic Sclerosis of the Yellow Ligaments, a Cause of Compression of the Cauda Equina** (Sclerosi pseudo-ipertrofica dei legamenti gialli causata da compressione della coda equina) CARLO FAIS. *Chir. org. movim.* 1946, 30: 261.

In this article, cases of pressure on the cauda equina resulting from pseudohypertrophic sclerosis of the yellow ligaments are reviewed. In addition, the author reports 2 cases proved at operation and by subsequent histological examination of the tissues removed at the time of operation which were observed during a series of 100 laminectomies performed for various reasons at the Rizzoli Institute of Bologna.

At the time that this article was accepted for publication June 27, 1944, the author could collect only 57 similar cases, 43 of which had been reported

by North American authors and only 9 reported by European authors, none of the latter in Italy.

After presenting his 2 cases, the author discusses at length the anatomy, histology, and physiology of the yellow ligaments and the etiology, concomitant lesions, anatomopathological picture, pathogenesis, subjective and objective symptoms, diagnostic signs and treatment of this condition.

The first case reported by the author was that of a 40 year old male who entered the hospital on August 28, 1940 complaining of backache of several years duration. Following a motorcycle accident on April 21, 1927, he had suffered constant lancinating pains in the lumbar region and was unable to bend or straighten his trunk. This painful contraction of his trunk was severe and caused him to remain in bed for a week. Following the application of heat the pain gradually diminished and he was able to return to work. During the next 12 years he experienced three similar attacks of lumbar pain without apparent cause, each attack lasting about one week and being relieved by the application of heat and rest in bed. In the interim between attacks the patient was bothered by constant weakness of the lumbar spine and pains of varying intensity upon even slight exertion. Spinal movements were limited.

August 15, 1938 the patient experienced another attack which was not relieved by rest in bed, application of heat, or the wearing of supporting girdles and corsets. The pain finally became localized over an area the size of the palm of the hand in the right paravertebral space at the level of the first sacral vertebra. Bladder and sexual functions were normal.

Physical examination revealed an athletic type of person with a very noticeable rigidity of the lumbar spine accompanied by a physiological lordosis. Pain was experienced on pressure over the right paravertebral space at the level of the first sacral vertebra and the right sacroiliac joint. Sitting and erect postures were painful but most pain was experienced when the patient was in a horizontal position.

Neurological examination revealed no motor disturbances. There was hyposenitivity to heat in the skin of the fifth lumbar and first sacral segments on both sides. The left knee jerk was absent and the left Achilles reflex was hypoaffective. Other reflexes were normal. Jugular pressure, cough, and deep inspiration provoked slight lumbar pain. There was no muscular atrophy.

Roentgenography of the spine revealed diffuse calcification of the lumbar spine, the articular apophyses were owl beaked and the space between the fourth and fifth lumbar vertebrae was narrowed.

Spinal puncture revealed normal fluid under normal pressure.

A myelogram, after the injection of lipiodol solution, revealed a descent of the opaque fluid to the normal distal limit with fragmentation of the opaque shadow at the levels of the last three lumbar vertebrae. With the patient in the Trendelenburg position there was a filling defect at the level of the fourth lumbar vertebra.

Laminectomy was performed on September 15, 1940 under local anesthesia. The yellow ligaments at the level of the fifth lumbar vertebra were found tenaciously adherent to the dura and so abnormally thickened that it appeared as if they were a separate tube.

Postoperative convalescence was normal and post operative results were satisfactory.

Histological examination of the yellow ligaments removed at operation showed a 12 mm thickening and the ligaments were composed chiefly of dense fibrous tissue and collagen fibers. Elastic fibers were sparse and diffuse. Many blood vessels had been obliterated. Large hyaline and calcareous deposits were scattered throughout the connective tissue. A histological diagnosis of pseudohypertrophic sclerosis of the yellow ligaments was made.

The second case reported by the author was that of a 48 year old male, who entered the hospital on August 4, 1941 with a past history of sciatica on the left side at 25 years of age without any relation to injury which was cured after a few weeks of medical treatment. Fifteen months before entry without apparent cause the patient began to notice lumbar pain with radiation to the left buttock. Eight months before entry the pain had spread to the whole left lower extremity. The pain was accentuated by lateral and anterior movements of the spine, and by the supine position. Six months before entry extension of the left knee became limited and a month later motor weakness of the entire left lower extremity developed.

Physiotherapy, x-ray therapy and local injections of various kinds had no effect on the disease.

Physical examination revealed a well developed adult male with rigidity of the lumbar spine and a slight deviation of the spine to the right, the convexity of the curve being to the left. There was pain on palpation with radiation of the pain to the left sciatic nerve. There was atrophy of the left lower extremity.

Neurological examination revealed, in addition to the motor weakness tactile and thermal hypesthesia of the anterolateral aspect of the left leg and foot. Reflexes were normal except that the left Achilles reflex was sluggish and the left plantar reflex was absent.

X-ray examination revealed sacralization of the fifth lumbar vertebra and lumbarization of the twelfth dorsal vertebra.

There was a reaction of degeneration of the muscles supplied by the nerves from the fourth and fifth lumbar roots. No electrical conduction occurred through these nerves.

Lumbar puncture showed normal fluid under normal pressure.

The myelogram, after lipiodol injection showed a defect of the opaque medium at the last lumbar interspace and with the patient in the Trendelenburg position there was a partial block between the fourth and fifth lumbar and the fifth lumbar and the first sacral vertebrae.

Laminectomy of the fourth and the fifth lumbar vertebrae under local anesthesia revealed a thickened yellow ligament with stenosis of the dura in the lumbosacral region. There was no herniation of the discs. The thickened ligament was removed to relieve pressure on the nerve bundles.

Postoperative recovery was uneventful and the lumbar and sciatic pain disappeared in a month. There was residual rigidity of the spine and permanent paralysis of the small sciatic, peroneal, and anterior tibial nerves.

Histological examination of the specimen of yellow ligament removed at operation showed a thickness of 8 mm. The ligament was composed of fibrous tissue and irregular collagen fibers with sparse elastic fibers, hyaline degeneration, and obliterated blood vessels. Diagnosis of pseudohypertrophic sclerosis of the yellow ligaments was made.

After a lengthy discussion of the anatomy of the yellow ligaments, the author concludes that the interlaminae portion of the yellow ligaments with the nerve roots is situated within the dura and is bathed in the spinal fluid while the interpeduncular portion with the ganglia is covered by the dura, but not by the arachnoid, and therefore it is not in contact with the spinal fluid. Eventual hypertrophy of the yellow ligaments can compress contemporaneously one or more bundles of the cauda equina or isolate a ganglion and cause a change in the spinal fluid to some degree.

The yellow ligaments have a characteristic color because they are made up almost entirely of elastic tissue, differing from other ligaments in this respect. The elastic fibers, from 5 to 6 micra in size appear in closely packed bundles. They lie chiefly in a vertical plane in the interlaminae portion and in an oblique plane in the interpeduncular portion but the fibers intersect transversely. Collagen fibers are sparse and the blood vessels are imbedded in the small amount of connective tissue that appears in the ligament.

The chief characteristic of the yellow ligaments is their elasticity. This characteristic enables the ligaments to perform an important part in stabilizing the vertebrae and aiding in the movements of the spine. When the nucleus pulposus, under tension, tends to separate the vertebral bodies, the elasticity of the yellow ligaments tends to bring together the laminae with the intervertebral articulations as a fulcrum. The nuclei pulposi of the intervertebral discs and the yellow ligaments have a synergistic action. When the spinal column is flexed the nuclei pulposi are displaced posteriorly and the yellow ligaments extend vertically when the spinal column is extended, the nuclei pulposi are displaced anteriorly and the yellow ligaments are drawn backward. In the lateral movements of the spine the nuclei pulposi move slightly to the side of extension and the yellow ligaments of the same side stretch, while those of the opposite side contract. In twisting movements, the nuclei pulposi form a hinge and the yellow ligaments stretch obliquely and laterally.

thus they contribute to the restoration of the normal position of the spine after each movement.

The condition under consideration occurs in individuals from 16 to 57 years of age according to the cases reported with the highest incidence in the fourth decade. It occurs more often in men than in women—in the ratio of 3 to 1. Both of the author's cases occurred in men in the fourth decade. The most common site of the hypertrophy is between the fourth and fifth lumbar and the fifth lumbar and the first sacral vertebrae. Hypertrophy most often occurs in the interlaminar portion with the syndrome of compression of the roots of the cauda equina, and less often in the interpeduncular portion. Indirect trauma is the determining factor in 75 per cent of the cases.

Concomitant lesions are herniation of the discs eventual thickening of the laminae at the insertion of the hypertrophied ligaments disintegration of the bodies of the vertebrae from fracture or neoplasm, and laceration of the yellow ligaments in cases of severe trauma.

The anatomopathological picture is one of atrophic sclerosis of the yellow ligaments with a stenosing action of the dural sac. The thickening of the ligament may vary from one to four times the normal thickness. Grossly the ligament appears a brilliant white because of the substitution of the normal elastic tissue by connective tissue. It becomes tenaciously adherent to the dura the epidural vessels are compressed, and the subsequent edema gives rise to a compression neuritis. Microscopically, the elastic fibers become disorganized and are later replaced by connective tissue. The blood vessels in the ligament become obliterated hyaline and calcium deposits are laid down and fatty degeneration is also present.

The first and most important symptom is acute lumbar pain following trauma in most cases which persists and increases in severity but in some cases the pain diminishes only to be followed by more frequent and severer attacks of pain after the slightest trauma. As the disease progresses and pressure is exerted on the nerve bundles of the cauda equina, the pain becomes referred to progressively descending parts of the lower extremity. Signs of motor damage may appear later.

Neri's sign that of lumbar and sciatic pain induced by forced flexion of the head on the thorax with the patient in the supine position can be elicited. Neri's sign is the most important sign of hypertrophy of the yellow ligaments as well as of hernia of the discs. This sign is demonstrated when compression of the jugular vessels elicits pain in the lower back. When nerve involvement has occurred the localized reaction of degeneration can be demonstrated. Heterological scoliosis with the convexity of the curve to the painful side often occurs. Painful contracture of the trunk and lower extremity with inability to completely extend the knee joint occurs when the pain is severe and long continued. Hypoesthesia of the anal and sacral regions and of the

anterolateral aspects of the leg and foot may occur. X-ray examination, following lipiodol injections into the subdural space reveals deformities resulting from pressure of the hypertrophied ligaments which causes partial or complete block.

Physiotherapy x-ray therapy and immobilization by means of corsets and braces are only of temporary benefit. Barring contraindications relief is obtained from laminectomy with removal of the pressure of the hypertrophied ligaments on the nerve bundles of the cauda equina. The site of operation is determined by myelography after lipiodol injections. Local anesthesia is used in most cases.

Postoperative results are good and the subjective symptoms and objective signs disappear rapidly after surgical intervention.

BLACKWELL MARKHAM, M D

#### Spinal Extradural Cyst: Report of a Case, with Particular Reference to a Possible Diagnostic Aid OSCAR A. TURNER. *Arch. New Psychiat. Chic.*, 1947 58 593.

The author reports a case of spinal extradural cyst in an 11 year old boy with progressive loss of power in the lower extremities over a period of 5 months. A spastic paraplegia was present with a sensory level at the ninth thoracic segment. Roentgenograms revealed enlargement of the vertebral canal chiefly in the region of the seventh and eighth thoracic vertebrae. There were erosion and atrophy of the pedicles and erosion of the posterior margins of the bodies of the affected vertebrae.

Spinal puncture revealed evidence of a complete block with xanthochromic fluid. After withdrawal of 4 c.c. of fluid improvement in motor function of the legs was noted an hour and a half later.

At operation a large extradural cyst was removed which showed direct communication with the subarachnoid system through a small defect in the dura.

Pathological study revealed the wall of the cyst to be composed of a double layer of rather heavy collagenous tissue, which was partly hyalinized. Between the inner and outer connective tissue layers forming the wall of the cyst was a layer of tissue formed either by a bank of cuboidal or flattened cells or by a mesh of elongated and stellate cells with interlacing processes.

The author believes that this represents a case of extradural spinal cyst associated with early roentgenologic manifestations of kyphosis dorsalis juvenilis and erosion of the pedicles.

He points out that the improvement in function of the lower extremities resulted from partial evacuation of the cyst, because of its communication with the subarachnoid system, and that this may be a useful sign diagnostically.

Anatomic evidence has been presented to show that the origin of the cyst is a herniation of the pia arachnoid through the dura, and chemical analysis of the fluids in the cyst and in the subarachnoid space would indicate that the fluids are identical.

HOWARD A. BROWN M D



## PERIPHERAL NERVES

**The Problem of Surgical Therapy in Lesions of the Peripheral Nerves** (Il problema della terapia chirurgica nelle lesioni dei nervi periferici) E. MINERACCHI and U. SACCHI. *Chirurgia*, 946, 407

It was noted that in late operations, that is, any time after a month from the time of injury the time required for recovery is about the same as when it is done earlier. For injuries to the tibial or peroneal nerves this ranges from 13 to 15 months.

To explain this phenomenon the theory is propounded that the regenerative process after a certain time must start from the trophic end of the cord and from thence advance down toward the point of injury at the rate of about 3 mm. per day just as pointed out by Cajal and others. A graph is presented which shows that in the cases in which there was a failure of regeneration the operation had not been done up to the time that this slowly advancing regenerative process reached the point of interruption of the nerve. The authors believe, therefore, that the nerve can be operated upon too late. Of course no definite period can be fixed for the operation of nerve suture; it will vary with the nerve injured, with the physical characteristics of the injured individual and with the level at which the nerve injury is located. The nearer the injury to the trophic center in the cord and the more proximal its location the earlier the operation must be done.

By observation of these limitations the operation of nerve suture can generally be expected to produce satisfactory results as far as procuring a return of contractile power to the larger muscles. However it has been abundantly demonstrated that the smaller muscles, such as those of the hands and feet, soon lose their capacity for regeneration whether this be due to a disappearance of the motor end plates or to early infiltration of connective tissue.

It would seem advisable to operate early on such nerves as the ulnar, peroneal or tibial in order to give them the chance to start regenerating from the point of injury instead of from the trophic center. Therefore the authors divide their cases into 2 groups: (1) those suitable for early suture of the nerves supplying small muscle groups and (2) those in which suture should be done after the second month when the process of regeneration has failed to respond in the manner described for the early operative case.

JOHN W. BRENNAN, M.D.

**The Use of Autogenous Grafts for the Repair of Large Gaps in Peripheral Nerves.** H. J. SKEDDON. *Brit. J. Surg.* 1947 35 5

Extensive loss of nerve tissue presents one of the most difficult problems in the repair of peripheral nerve injuries. In the author's series of 600 cases requiring operative repair it was found that 8.6 per cent of the patients had lesions that were repairable only by the use of nerve grafts. Despite occasional case reports on the successful use of both hetero-

nous and homogenous grafts, it is the unequivocal opinion of the author that such grafts are not of the slightest use in clinical practice; hence only the use of autogenous nerve grafts offers any hope for recovery in these cases.

The present report is based upon the results obtained in 58 cases in which nerve autografting had been performed. There are several technical considerations that must be borne in mind in treating such injuries. A basic factor that has received scant attention in the past is that the graft, or collection of grafts, must have a total cross section area at least equal to that of the peripheral nerve to be repaired. This should apply both at the proximal and distal portions since it is obvious that if the nerve graft is smaller at one end it is not likely that the entire number of regenerating nerve elements would be able to pass through the graft.

In the use of cutaneous nerves, one should ascertain that there are no bifurcations of the nerve during its course. Four specific cutaneous nerves were found to be of exceptional value. These are as follows: the internal cutaneous nerve of the forearm proximal to its bifurcation at the elbow, the superficial radial nerve, the sural nerve and the saphenous (internal saphenous) nerve in the thigh. Although there have been theoretical objections to the use of cutaneous nerves in the repair of nerves in which motor fibers might be anticipated these have been completely dispelled by the present series. A segment of the trunk of a main nerve may be used very satisfactorily when two large nerves are damaged and it is considered possible to repair only one. Although there is a definite risk in the use of large nerve grafts because of the possibility of ischemia with resulting collagenization, it is nevertheless a worth while procedure. It is possible that Strange's pedicle grafting technique will prove the solution to this problem. Predegenerative grafts have also been advocated however the author is not completely satisfied with this theory.

The operative technique in nerve grafting of autogenous nerves is essentially similar to that for other nerve suture; however there are several factors which require emphasis. In cases of severe cutaneous scarring it is usually advisable that the repair be made by plastic surgery with the use of full thickness flaps before performing the definite nerve repair. At this time it is usually possible to determine what type of nerve repair will be required. Mobilization of the nerve stumps may be carried out if the defect is so great that a sufficient supply of graft material may not be obtainable. However in this case, it must be remembered that extreme flexion of the joint or marked stretching of the nerve is not advisable. Flexion of the knee or elbow beyond 90 degrees is considered hazardous. Resection of the end bulb should be carried out similarly to that in any other type of nerve repair. There is seldom any difficulty in resection of the proximal bulb since the existence of the neuroma itself is indicative of healthy axons. The distal nerve stump requires much more exten-

sive resection since collagenization may extend for a considerable distance. The bed for the graft should be in a healthy vascularized area. If there is extensive scarring, it is worth while to consider the by pass operation in which case the nerve is either tunneled or placed through healthy tissue. Since it is now well recognized that grafts shrink it is advisable to secure a graft at least 15 per cent longer than the gap to be closed. If at all possible a graft from a distal stump should not be used especially if in jury has occurred more than 6 months previously.

The author stressed the need for a meticulous and precise technique in suturing of the nerve. Since the handling of cutaneous nerves is extremely tedious and hardly permits of satisfactory suturing with thread the author prefers the use of the plasma clot fixation. He has not found the use of the molds as devised by Tarlov convenient. Instead he builds up the surrounding area by the use of either bone wax or fibrin foam to make a small lake about the area to be sutured, and pours in the prepared plasma following which the bone wax or fibrin is removed.

An evaluation of 52 of the 58 cases that had been followed sufficiently long to permit a fair assessment reveals that in 20 cases (38.5%) recovery was as good as that following end to end suture. Seven patients were showing satisfactory recovery although their end result was not fully evaluated. Partial but useful recovery had occurred in another 8 cases which made the operation of the autogenous nerve graft a valuable procedure in 67.3 per cent of the cases.

JACK I. WOOLF, M.D.

### SYMPATHETIC NERVES

**Sympathectomy for Obliterative Arterial Disease; Indications and Contraindications.** NORMAN E. FREEMAN, FRANK H. LEXES and RICHARD E. GARDNER. *Ann Surg.*, 1947 126 873.

It is well recognized that sympathectomy is useful in the treatment of peripheral vascular disease when associated with vasospasm and abnormal vasoconstriction. Although verification of the vasospastic elements by preoperative diagnostic tests is helpful, lasting and progressive improvement may be attained even when these tests fail to reveal satisfactory results. Since vasodilator tests may not allow sufficient time for maximum effect, great reliance has been placed upon the subjective improvement after such tests.

Clinical tests have been utilized by the authors in the selection of patients with intermittent claudication for sympathectomy but they emphasize the importance of the presence of the following signs of abnormal vasoconstriction: (1) peripheral cyanosis, (2) increased sweating and (3) constriction of superficial veins of the extremity. Delayed blanching on elevation of an extremity is also of significance. Whether this is due to venous constriction and concomitant arterial constriction remains theoretical.

A contraindication to sympathectomy that has failed to receive widespread recognition is advanced obliterative arterial disease. In such cases delayed gangrene may ensue. The authors discuss the cases of 4 patients who developed gangrene. The following frequent contraindications were noted: (1) pain due to ischemic neuritis, (2) rapid blanching on elevation, (3) absent oscillations at the ankle and (4) atrophy of soft tissues.

The unusual site of the gangrene (on the dorsum of the foot) is somewhat similar to that following proximal ligation of a major artery in the presence of an arteriovenous fistula. In this case there is a precipitous drop in the pressure due to a greatly expanded vascular bed on the venous side. In advanced obliterative vascular disease the major arteries are already blocked hence destroying the vasomotor tone of the arteriovenous anastomoses permits the blood to be abruptly shunted into the venous system.

JACK I. WOOLF, M.D.

**An Anatomic Evaluation of Operations for Hypertension.** G. A. G. MITCHELL. *Edinburgh M J* 1947 54 545.

In view of the increasing evidence of the value of sympathectomy in the treatment of hypertension and because of the widespread variance and extent of the operation as it is being performed the author believes that its evaluation on anatomic grounds is indicated at the present time. In order to make this evaluation however it is necessary to determine what effects are desired. The consensus of the various authorities who have performed the greater number of these operations is that the attempt should be made: (1) to produce widespread vasodilatation of the greater part of the abdominal splanchnic area, (2) to denervate the vessels of the lower limbs in order to produce somatic dilatation in these parts, (3) to denervate the kidneys in order to intercept possible reflex vasoconstrictor impulses and (4) to denervate the suprarenal glands to diminish the secretion of adrenaline and to prevent vasoconstriction of the suprarenal vessels.

There are certain basic requirements or factors which must be kept in mind when considering the type of operation that is necessary to produce the aforedescribed effects since they may also influence the type of operation or procedure selected. First of all the operation must carry a minimal risk to life which is consistent with the production of the desired results. It should also produce as few undesirable sequelae as possible. It should be sufficiently extensive to prevent nerve regeneration and should be preganglionic rather than postganglionic in type. The incision for the operation should allow exploration of the renal suprarenal and paravertebral areas in order to rule out the possibility of associated tumors in these regions which may be a possible cause of the hypertension.

The variability of the peripheral distribution of the sympathetic nerves must influence the extent of the operative procedure since it has been shown that the

escape of only a small proportion of the nerve fibers supplying certain viscera or vessels may produce effects entirely disproportionate to their numbers.

Fifty four dissections were performed. In 8 specimens, nerve rootlets of the greater splanchnic nerves arose at a level as high as the fourth thoracic ganglia, and in one case, as high as the third thoracic ganglia. Many of the upper rootlets supply the aortic and esophageal filaments and some of these may pass downward to the abdomen along the aorta and hence escape in the ordinary thoracodorsal sympathectomy. In approximately 10 per cent of the dissections a para-aortic nerve was seen. Occasionally this nerve had upper fibers arising as high as the fourth or fifth thoracic ganglia.

The author suggests that the optimum sympathectomy required for the treatment of hypertension should be a bilateral resection of the sympathetic trunks from the fourth ganglia to the third lumbar ganglia with removal of all the splanchnic nerves, since only an operation of this magnitude will satisfactorily denervate the desired areas or those considered necessary by the majority of investigators. Nevertheless it is realized that even an operation of this extent may allow the escape of certain sympathetic nerve filaments. JACK L. WOOLF, M.D.

#### MISCELLANEOUS

Post Traumatic Osteoporosis Algica or the Syndrome of Sudeck, Treated by Novocainization of the Stellate Ganglion (Osteoporosis algica post traumática o síndrome de Sudeck, tratada por novocainización del ganglio estelar) ISIDORO PASCAU Cir. ortop. y mal., Habana, 946 3 3

One hundred and thirty-three cases of Sudeck's syndrome are reported. Of these 93 (70%) resulted from a Colles fracture the rest represented various fractures of the bones of the forearm, wrist and

hand. 4 were displaced fractures of the surgical neck of the humerus and 1 was a partial and another a total avulsion of the greater tuberosity of the humerus. The last was accompanied by dislocation of the shoulder joint which had remained unreduced for 48 hours following the injury. The remaining cases were instances of woundings and infections.

Treatment consisted exclusively of novocainization of the stellate ganglion by the technique described by Debakry-Ochaner with a slight variation. By this method the ganglion was blocked once or twice a week, and a total average of 12 injections was given. Of course preventive measures, especially in these fracture cases, should be carried out. In any case of fracture in which the fingers become cyanotic, seem to be losing mobility and flexibility or in which edema appears, the cast should be loosened or the hand freed especially in the Colles fracture, the extremity should be elevated, and active exercises, such as the crinkling together of a silk handkerchief or the squeezing of a partially inflated rubber ball should be initiated.

However when the syndrome is definitely established the author uses only the method of novocainization of the stellate ganglion in the neck and then stimulates active movements. For the latter purpose he uses a special stimulus to muscular recovery in the guise of ionization treatments with mecholil or another acetylcholin derivative. The pain and muscular debility disappear sooner than the roentgenographic changes in the bones.

The author believes that the novocainization method is equal to or better than excision of the stellate ganglion as it does not leave a lasting Horner's syndrome in its wake. No deaths and no serious complications have been observed with this method. The only troubles noted were a slight transitory aphonia, nausea, dizziness and some sensation of oppression in the chest. JOHN W. BRENNAN, M.D.

# SURGERY OF THE THORAX

## CHEST WALL AND BREAST

**Malignant Myoblastoma of the Mammary Gland**  
(Sul mioblastoma maligno della mammella) VIRRO  
LORIZZO *Gior ital chir* 1947 3 486

A 36 year old woman noted a small tumor in the upper outer quadrant of her left breast 6 months before she presented herself. When first seen the mass was the size of a large orange. It was covered by a tensely taut skin which could not be raised in folds and showed a moderate amount of venous marmoration. The neoplasm was of a densely elastic consistency and was not painful to palpation. It could not be displaced on the underlying tissues. The breast itself was freely movable. A diagnosis of adenocarcinoma was made and the breast and axillary lymph glands were removed en bloc. One year later the new growth had recurred in the guise of a slightly mobile, dense hazelnut-sized tumefaction in the healed scar of the original operation. The recurrent mass regressed under the application of roentgen therapy.

Histologic examination disclosed even under low power of the microscope a cell rich parenchyma with meager connective tissue stroma extending in a diffuse manner among the tumor cells. These cells varied greatly in size and shape and in their number of nuclei. There were numerous small, rounded fusiform cells disposed in featureless masses or tending to arrange themselves in what resembled bundles reminiscent of bundles of muscle cells. Even in these smaller cells there was evidence in places of longitudinal striation. The larger cells were often giants, even larger than the Langhans cells of tuberculous granulomatous tissue. These huge cells had usually more than one nucleus (from 2 to 15). The nuclei varied in size in position in the cytoplasm of the cell in their content of chromatin (usually in excess) and in the number of nucleoli. The polymorphism of these cells defies detailed description; however there were numerous square forms or forms drawn out in bandlike structures with a thick cell membrane along the longer side, the shorter side being practically without cell membrane, as though it were broken off abruptly. The voluminous cytoplasm in these cells was definitely eosinophilic and there was vague or definite evidence in the cytoplasm of longitudinal striation. There were ribbonlike bands resembling the cytoplasm of the aforementioned giant cells, but without nuclei. When nuclei were present, they were usually elongated and disposed along the periphery of the cell as a rule along the longer side and frequently on alternating sides. There were also huge cells of rounded shape or in the shape of a palette, that is, with a rectangular or bandlike process extending from the main cell mass. These processes never contained nuclei but were especially rich in longitudinal striations.

With a stain of sierra-orange these giant cells were found to be particularly rich in salts of potassium. The lymph glands from the axilla gave no histologic evidence of metastasis.

This tumor is considered a malignant myoblastoma in accordance with the classification given in Tonelli's recent study of this subject (*Arch Vecchi* 1943 vol. 595)  
JOHN W BRENNAN M.D.

**Testosterone in the Treatment of Breast Carcinoma.** FRANK E. ADAMS. *Med. Clin. N. America* 1948 32 18.

The author prefaces his article with a discussion of the literature on the treatment of cancer of the breast with androgens. The first reports of cases in which this method of treatment was used were presented in 1939, by Loesser, Ulrich, Farrow and Woodard, and Fels, Prudente and Bolger followed with reports of varying success in the treatment of carcinoma of the breast with this substance.

Testosterone has been used in many forms. The propionate and acetate forms are administered in transmuscularly crystalline pellets by subcutaneous implantation and methyl testosterone is given orally.

Loesser suggests the possibility of forestalling the reappearance of cancer in patients in whom all known breast neoplasm has been eliminated. He cites one case in which no beneficial effect from the testosterone was obtained but it seemed to influence the eventual favorable response to roentgen therapy. The adverse effects are limited to hypercalcemia.

The present report is based on the author's experience with testosterone therapy in 450 cases of carcinoma of the breast. Following the implantation of 300 mgm. of testosterone there resulted skipped menstrual periods, hirsutism deepening and huskiness of the voice, an increase in sexual desire, and acne. Besides this virilizing effect and the improvement in general health, testosterone exerts a direct and an indirect effect on cancerous tissue. There may be a diminution in size of the primary or metastatic tumors. In bone metastases, the improvement may be direct or indirect because of sclerosis at the site of the metastasis or in the osseous system as a whole.

Instances of improvement are much more common and striking in bone metastases than in soft tissue recurrences. Following testosterone therapy the entire osseous system becomes more dense, the local areas of destruction often fill in with bone salts with frequent restoration of trabeculae and contour. These changes have been observed in the roentgenogram. While local lesions may undergo complete repair, other bony lesions may not be influenced and may continue to increase. Two cases are reported in which patients with bone metastases obtained relief for a period of 2 years.

The author believes that we now have an agent that is capable of prolonging the life of the patient,

in fairly good condition for 3 years at least. With further experience in the use of hormone therapy, palliation may be obtained for a longer period of time. Usually the patient begins to feel relief of pain after from 2 to 3 weeks of hormone medication. The author presents the case of a patient with abdominal metastases who showed remarkable response to testosterone therapy. Little improvement in liver and chest metastases has been observed.

The author favors a plan of dosage whereby the patient receives 100 mgm. of testosterone propionate intramuscularly three times a week for a period of 10 weeks, following which a maintenance dose of 40 to 60 mgm. daily of methyl testosterone by mouth is given for 8 weeks. Enough hormone to inhibit estrogenic action should be given this amount remains to be established.

There are no contraindications to testosterone therapy in patients with advanced cancer of the breast. In general, the results which may be anticipated following androgen therapy are: relief of pain, removal of disability, increased appetite, weight gain, ability to sleep without the aid of narcotics, delay in the normal growth processes of metastatic cancer and a feeling of well being. Even though the results are frequently disappointing, it is believed that the influence of testosterone on mammary carcinoma is so striking that clinical and metabolic studies should be pursued with vigor.

ROBERT R. BICKLOW, M.D.

**The Relationship Between the Stage of Tumor Development and Age in Determining the Prognosis of Breast Cancer** (Die Abhängigkeit der Prognose der Mamma-Carcinome vom Tumorstadium und vom Lebensalter anhand von 703 Fällen) H. R. SCHNITZ and Ch. BORTZMANN. *Acta radiol. Stockh.*, 1947 28 611.

Of 1,033 malignant lesions of the breast seen at the Institute of Radiation Therapy in Zurich between 1919 and 1945 703 have been carefully classified according to the classification of Schinz and Steinthal. These have been related to the ages of the patients, and several facts are brought to light. In the authors' experience, younger women presented themselves more frequently in the early stages of the disease, while older women more frequently presented themselves with wholly inoperable lesions. In the younger women small tumors appeared to give rise to metastases earlier than in older women. The cases of advanced local lesions with no metastases occurred almost exclusively in older women.

In a small number of patients almost all older women, there was a tremendous local infiltration without any metastases and with a relatively very good prognosis. However when the same stages of tumor development are compared the results are identical in the older and in the younger women. By a careful classification on a purely clinical basis, it was possible to estimate the chances of cure within from 10 to 30 per cent. WILLIAM C. BECK, M.D.

**Follow Up Examination of 103 Cases of Cancer of the Breast with the Purpose of Evaluating Preoperative and Postoperative Irradiation Therapy** (Examen ultérieur de 103 cas de cancer du sein en vue de l'appréciation de la radiothérapie pré et post-opératoire) M. ANDERSSON. *Lancet chir.* 1947 4 702.

This material originating from the surgical clinic of Dahl Iversen in Copenhagen, Denmark, is divided into three parts according to the method of classification by Steinthal, the first consisting of 29 patients with a small nonadherent primary tumor and absence of metastases in the axillary lymph glands; the second of 42 patients with a moderately sized tumor and invasion of the axilla; and the third of 32 patients with a large, rapidly growing tumor adherent to the skin or underlying muscle or to both, and with metastases in the axillary lymph glands.

All of the patients were given postoperative irradiation treatment and every other one was given preoperative roentgen therapy in addition. Preoperative treatment consisted of 3,000 roentgens given through 3 portals and in 3 weeks time. The patients were operated upon after 4 weeks. The postoperative therapy was started about 2 weeks after the operation and again consisted of 1,000 roentgens per portal for a total of 3,000 roentgens.

The material was rechecked 3 years after operation and again after 5 years. In the period between the third year and the fifth year recurrences developed in 15 per cent, which showed that the period of observation of 3 years is not long enough to postulate a cure. Of the original material of 103 patients all were living at the end of 5 years except 4. These apparently did not die of their cancer. Of the 99 remaining patients 38 per cent did not show any evidence of recurrence at the end of 5 years. However there were only 3 recurrences in group 1, 28 in group 2 and 30 in group 3.

The great importance of the invasion of the axillary lymph glands is emphasized. Of the 29 patients in whom these glands were not involved 24 (80 per cent) remained without recurrence while among the remaining 70 there were only 14 (19 per cent) who were free from recurrence at the end of 5 years. Another important observation on this material is that 51 per cent of the recurrences took place in the supraclavicular lymph glands; this argues for extension of the operative field in cases of this type.

No definite evidence could be obtained from this material that the results to be expected from combined preoperative and postoperative irradiation therapy are any better than those from postoperative therapy alone. JOHN W. BRENNAN, M.D.

## TRACHEA, LUNGS, AND PLEURA

**Surgical Aspects of Bronchiectasis.** JOHN W. STIMP. *Br. J. Surg.* 1948, 358 op.

The definitive treatment of bronchiectasis is surgical excision of the involved segments if their total extent is not extensive.

The results of medical management are reviewed on the basis of numerous series. Medical treatment was found to be inadequate. A summary of the collected data on medically managed bronchiectasis indicated that less than 10 per cent of patients with severe bronchiectasis obtain a satisfactory result, and that the mortality in from 10 to 15 years after diagnosis is between 30 and 50 per cent.

The improved technique of pulmonary resection by individual treatment of the hilar structures, as well as the advent of such adjuncts as penicillin has brought surgical treatment to a very safe level. Likewise, the refinement of segmental resection increases operability by conservation of useful lung. Operative mortality figures vary according to the circumstances involved but are given at as low as 1 per cent. In bilateral bronchiectasis the risk is increased not only because of multiple operations but because convalescence from the first resection must take place in face of persistent contralateral disease.

The results of 93 operations on 72 patients on the author's service which included multilobar as well as bilateral cases indicated a 9.7 per cent case mortality rate and a 7.5 per cent operative mortality rate (deaths directly attributable to operations).

The nonsurgical measures include postural drainage and bronchoscopy. The latter is important in ruling out concomitant or complicating intrabronchial lesions. Penicillin, although very beneficial in improving the patient's condition in preparation for surgery will not provide for permanency of results.

The more important complications of bronchiectasis such as putrid empyema, extensions of infection, metastatic brain abscess and hemorrhage are elaborated upon.

This paper was given as part of a symposium on bronchiectasis before the Massachusetts Medical Society, Boston, and is a concise but comprehensive review of the subject. HIRSH T. LANGSTON, M.D.

**Cystic Disease of the Lungs.** WILLIAM L. ROOKER.  
*West. J. Surg.* 1948 56 157

The author reviews 6 cases of patients suffering from cystic disease of the lungs, all probably congenital in type. He presents certain criteria to assist in classifying the clinical cases.

Primary resection is advocated in most instances in which surgical intervention is indicated as the procedure of choice. However, the congenital type may present instances in which palliative decompression and drainage or multiple stage operations would be desirable. The paper is well illustrated.

STEPHEN A. ZIEMAN, M.D.

**Studies in Lung Abscess. Anaerobic (Fetid) Lung Abscess. Aerobic (Nonfetid) Lung Abscess.** R. C. BROCK. *Guy's Hosp. Rep.*, Lond. 1947 96 97 125

Brock discusses anaerobic and aerobic lung abscesses. He stresses the fact that the expectoration of pus, whether offensive or not, is important to the diagnosis of lung abscess. Lung abscess is regarded

as a clinicopathologic condition due to many different causes and processes. It is not an entity in itself.

Primary anaerobic (fetid) abscess is essentially an acute suppurative pneumonitis proceeding to a greater or lesser degree of gangrene and is characterized by a peculiar penetrating and exceedingly offensive smell. The smell arises from an anaerobic infection, often mixed which both causes the gangrene and flourishes on the dead tissue.

It is probable that the varied combination of spirochetes, fusiform bacilli, streptococci and other micro-organisms can cause anaerobic or fetid lung abscess in favorable circumstances and it may be that as yet unrecognized organisms, particularly anaerobic streptococci, are involved. Certainly actinomyces may be present and may be the only organism found in some cases of foul lung abscess.

The morbid anatomy considers acute fetid lung abscess (a) with formation of a slough and (b) without formation of a slough and chronic anaerobic pneumonitis complicated by or followed by new acute abscesses.

The clinical features show acute pulmonary gangrene and acute fetid lung abscess.

Secondary fetid abscess depends principally on an antecedent history of operation, dental sepsis or the like. An infected lung cyst may mimic a fetid lung abscess. Bronchiectasis, intrapulmonary or intra-bronchial foreign body, bronchial carcinoma or adenoma and tuberculosis may introduce diagnostic difficulties. All these conditions may produce foul smelling sputum which contains anaerobes.

Treatment includes operative drainage but chemotherapy has achieved success without operation. The former should not be neglected because of the latter but should be done when resolution is slow.

Aerobic lung abscess in many cases is almost identical with acute fetid lung abscess except for the absence of the fetid smell; it is typically segmental in origin and most of what has been said about the pathology of fetid lung abscess applies to it also with the chief difference that a slough is not commonly found.

The fundamental process in the formation of a typical nonfetid abscess is generally a segmental pneumonitis due to bronchial embolism which proceeds to cavitation with the formation of a slough in very rare instances.

Primary aerobic lung abscess may be segmental or nonsegmental; the process may remain confined to one segment or skip to other segments of the lung. The clinical features differ little from those of the fetid type of abscess and the management of both types is similar. STEPHEN A. ZIEMAN, M.D.

**The Rational Basis of Endobronchial Medical Treatment of Lung Abscess (Bases rationnelles du traitement médical endo-bronchique des abcès du poumon).** MAX FOURRESTER and YVES LE BOUCHER. *Presse méd.* 1947 55 822

Ten cases of pulmonary abscess were treated either with penicillin alone or with a combination of peni-

cillin and sulfonamide instilled endobronchially. The result was excellent in all cases.

Before the treatment is started bronchoscopy is done and the bacteriology of the pus is examined. If gram-positive organisms only are found, penicillin alone is used. If gram-negative bacteria are present as well, sulfonamide is used in addition to penicillin. A dose of 400,000 units of penicillin is instilled endobronchially through a Metras tube three times weekly after previous anesthetization of the area with 0.5 per cent pantocain solution. In cases of mixed infection 1 gm. of a water soluble sulfonamide is added to the instilled penicillin. In addition to the local treatment, penicillin alone or penicillin plus some sulfonamide is given intramuscularly in the amount of 1,000,000 units of penicillin and 5 gm. of sulfonamide daily.

This treatment had to be continued for from 1 to 2 months until all signs and symptoms of the abscess had disappeared. WERNER M. SOLMITZ, M.D.

**Mucoid (Gelatinous) Lung Cancer Characterized by Pronounced Bronchorrhoea (Cáncer gelatinoso del pulmón d forma broncorrhea).** JUAN CARLOS DEL RÍO and PRIMO RUJSTEIN. *Am. Cated. pat. clin. Intern.* 916 B 334.

This report concerns a man aged 62 who was seen in July 1945. In July 1944 he had suffered from a respiratory infection which was considered to be pneumonia on the right side. This was followed by a rather prolonged convalescence but he remained well thereafter until March, 1945, when the previous small amount of mucopurulent sputum began to increase in volume reaching 1500 c.c. on some days. The expectorated material was transparent, thick, and slightly frothy. He had lost 5 kgm. in weight over a 4 month period.

Studies after admission showed no fever, and no cardiovascular disease could be recognized. Urine and serologic examinations were negative.

X-ray examination revealed an opacity in the right lower chest conforming to the middle lobe distribution. Evidence of nodular infiltrates was noted in the left base and hilar region also. Bronchograms were not diagnostic, but showed no evidence of obstruction.

Sputum studies were not informative, being negative for acid-fast bacilli as well as for evidence of neoplasm.

Bronchoscopy revealed the source of sputum to be the right middle lobe but no cancer was seen.

Thoracentesis failed to yield fluid from the right chest. An aspiration biopsy from the right lung was performed and this material permitted the diagnosis of mucoid (gelatinous) carcinoma.

The patient was thereafter discharged, dying 4 months later. No autopsy is reported but the sputum had continued to be copious in amount and the changes as seen by means of roentgenography had been progressive.

Only 2 other such cases were found in the literature. These were published in 1841 and 1936. Both

of these cases were diagnosed by postmortem examination. The mechanism responsible for such copious outpouring of secretions is not clear.

IRVING T. LANGSTON, M.D.

**Decortication of the Lung in the Treatment of Tuberculous Empyema.** CONRAD R. LAX. *Arch. Surg.* 1948, 56: 1.

It is obvious that the procedure of decortication cannot be applied indiscriminately in all cases of tuberculous empyema. The parenchymal kidney must not be forgotten. The fluid and cortex may actually be beneficial for a while, because of their immobilizing and compressive effects. Sooner or later, however, one must decide whether the lung should be re-expanded or permanently collapsed. Decortication may be of value regardless of the decision.

If re-expansion of the lung is decided upon, decortication without thoracoplasty is the operation of choice. If intrinsic factors in the lung prevent its expansion, some alteration of the thoracic wall, obviously may be necessary. If permanent collapse is desired, extrapleural thoracoplasty may be supplemented with decortication to achieve final obliteration of the pleural space.

Pulmonary decortication was applied, with gratifying results, to 3 patients with effusions and unexpandable lungs which complicated treatment by pneumothorax. In 2 cases, the procedure was used as an adjunct in the closure of large wounds of the chest, following extensive thoracoplastic procedures. In the third case it was used as the primary attack on an unexpandable lung. SAMUEL KARY, M.D.

## HEART AND PERICARDIUM

**Syndromes of Aberrant Right Subclavian Artery with Patent Ductus Arteriosus.** HENRY P. BIRAN and EDWARD D. D. NEUMACHER. *Am. J. Roent.* 1947 55 708.

The authors detected 15 cases of aberrant right subclavian artery by roentgen examination at the Infants and Children's Hospitals in Boston from September 1945 to August 1946. In 5 of the patients there was concomitant heart disease of a congenital nature (patent ductus arteriosus in 3 cases, the tetralogy of Fallot in 1 case and an anomaly of a certain structure but apparently involving an intracardiac shunt in 1 case). In 2 of the 5 cases the condition—a patent ductus arteriosus in one case and a tetralogy of Fallot in the other—was surgically verified.

The 5 cases of aberrant right subclavian artery associated with congenital anomalies of the great vessels at the base of the heart are reported in detail. In 4 cases the respective roentgenograms are presented for the purpose of illustration.

The aberrant right subclavian artery takes origin from the extreme left side of the aortic arch and passes obliquely upward and to the right behind the esophagus. In so doing it produces pressure on the posterior wall of the esophagus. By administering a swallow of barium mixture a typical oblique extrin-

air filling defect appears in the barium column which is especially well visualized in the lateral view. An anomalous subclavian artery passing between the esophagus and trachea or anterior to the trachea is uncommon and has not been encountered in the authors series.

Of particular interest is the relatively high incidence of coexistent congenital heart diseases in the syndrome of aberrant right subclavian artery. The fact that a patent ductus arteriosus was observed in not less than 3 out of 15 patients suggests to the authors that the two entities may be related either by one constituting a direct causation for the other or by virtue of a common etiology and pathogenesis of both. The presence of certain virus infections in the first trimester of pregnancy may have in this respect a definite role. In one of the authors' cases the mother of the patient had German measles in the second month of pregnancy. There is accumulating evidence in the literature to the effect that German measles in early pregnancy is a common and potent factor in producing congenital heart disease, cataract, deafness and other anomalies.

The authors discuss also the embryologic background of the syndrome of aberrant right subclavian artery and associated congenital heart disease. In the transformation of the aortic arches during the second fetal month the fourth arch is normally absorbed just proximal to its junction with the dorsal aorta; the remainder of the arch becomes the normal right subclavian artery. In the anomaly, the proximal portion of the arch is absorbed instead; the portion of the arch which joined the dorsal aorta then constitutes the aberrant subclavian artery. In the presence of a coexistent tetralogy of Fallot it is reasonable to assume that both defects arose from the same disturbance of embryologic development. In the case of patent ductus arteriosus however the infectious theory appears more plausible; the defects being manifestations of a basic fetal abnormality induced by the virus agent.

In conclusion the authors stress the value of a routine barium swallow during roentgenoscopic examination of the heart and lungs.

T LEUCOTIA M.D.

## ESOPHAGUS AND MEDIASTINUM

Present Day Concepts on the Treatment of Esophageal Perforations. FRANCIS L. LEDERER, ARNOLD A. GROSSMAN and W. ALLEN DOWDNEY. *Ann. Otol. Rhinol.* 1947 56 867.

Even before the advent of present chemotherapy there were conflicting schools of thought on the treatment of esophageal perforations. The problem is still undecided.

The interventionists recommend cervical mediastinotomy as soon as the diagnosis is made. The conservative group would rather wait and see if complications such as mediastinitis develop before they advise surgery if at all. Since the use of penicillin, the conservative method is no longer as great

a threat as it was before chemotherapy when 87 per cent of the cases terminated fatally.

Penicillin plays an important part in the treatment of this disease if we understand its limitations. It has by no means obviated the necessity of surgical intervention, especially when complications such as mediastinitis, pleural effusion, or empyema have occurred. Penicillin alone or with pleural aspirations, and the instillation of penicillin or streptomycin have been followed by cure in some cases.

Prior to the use of penicillin prophylactic cervicotomy done immediately, resulted in a 27 per cent death rate and the authors believe that chemotherapeutic intervention associated with this procedure would be the most logical approach. Posterior mediastinotomy carried out at the same time or later has been recommended by some authors when the infection spreads to the posterior mediastinum below the fourth thoracic vertebra.

Both Churchill and Neuhof recommend early operation on patients with esophageal perforations without waiting for the infection to wall off or for roentgenographic evidence of mediastinitis to develop.

Since the use of penicillin the pendulum has swung to the side of the noninterventionists. If a diagnosis of esophageal perforation is made, the procedure should be as follows:

Instillation of 100,000 units of penicillin intramuscularly every 4 hours; nothing should be taken by mouth; intravenous feedings should be given; or a gastrostomy is done in long drawn-out cases; the patient is placed in Trendelenburg position to prevent secretions from running down the esophagus; 100 per cent oxygen is administered to combat cyanosis, dyspnea and restlessness; 50 mgm. of demerol is given every 4 hours as a sedative; anaerobic as well as aerobic bacterial investigations should be carried out; hydrogen peroxide sprays should be used to combat mouth organisms; iron and arsenic cacodylate (1 gr. daily) is given intravenously for 7 days; anti-gas gangrene and tetanus antitoxin and small and repeated blood transfusions should be administered; sulfadiazine (1 gm. every 4 hours) and streptomycin (0.25 every 4 hours intramuscularly) should be started as early as possible; thoracic surgeons keenly observant of such cases should be consulted.

When is surgical intervention indicated? The authors believe prophylactic cervicotomy should be performed in all cases of high esophageal perforation. Even though one adopts the conservative approach outlined, surgery still may be indicated in the later phases of this condition. Certain indicators repeated at frequent intervals will aid in the decision for surgical intervention. These are: (1) a history of known or suspected esophageal trauma; (2) roentgenographic evidence of air in the tissues; (3) clinical evidence of prevertebral or mediastinal emphysema; and (4) the course of the white blood count, the pulse and the temperature.

If these indicators show no progression of the disease expectant treatment can be continued. If



roentgenographic evidence and clinical findings plus some or all of the "indicators" show progression of the disease process. Immediate surgery should be carried out in the area indicated. If it is a high esophageal perforation alone then a cervicotomy must be performed at once. Following this, all "indicators" must be continued. If the chest film shows progression of the lesion chest aspiration and instillation of penicillin or streptomycin is indicated.

If in spite of this, the lesion progresses as evidenced in the volume of pleural effusion, determined by roentgenographic study then posterior mediastinotomy is the immediate and urgent treatment of choice.

Three cases are presented which illustrate the above outlined management. All 3 patients were treated with penicillin and all survived. One patient required major surgery in another pleural aspiration with local instillation of penicillin was necessary and in one patient conservative measures alone were enough.

The authors describe the treatment of esophageal perforations in 4 patients before the use of penicillin one of whom survived.

The early symptoms of esophageal perforation are (1) severe insistent pain at the site of perforation or between the shoulder blades, (2) dysphagia and expectoration of small quantities of blood and (3) dyspnea and restlessness.

ROBERT R. BICKLOW M.D.

**Surgical Treatment of Cancer of the Thoracic Esophagus (Traitement chirurgical du cancer de l'oesophage thoracique)** P. SARRY and ALAIN MOUTIER. *J. chi. Par.* 947 63 505.

Surgical treatment of cancer of the esophagus is justified because of its great frequency, its serious consequences, its failure to respond to other methods of treatment, and its relatively long period of operability. The annual deaths due to cancer of the esophagus range from 1,000 in Argentina, 2,500 in England and more than 9,000 in the United States to 25,000 in Europe. In 1939, Ballivet could collect only 24 cases of surgical cure, while today the number of cures exceeds 400. The operative mortality has dropped from 71 per cent in 1941 to from 15 to 30 per cent. Metastases develop late in esophageal cancer. The percentage of operability increases with the experience of the surgeon and today radical extirpation, even of tumors adhering to both pleurae, lungs, or a bronchus is advocated. A brief résumé of the historical aspects of surgery of esophageal cancer, of the surgical anatomy of the esophagus, and of the pathologic anatomy of thoracic esophageal cancer follows.

The frequently long period of latency between onset of the malignant process and appearance of clinical symptoms is emphasized. Frequently patients do not arrive for treatment until 4 or 6 months after the onset of symptoms. The tumor may remain operable for a long time after symptoms have appeared but in some instances it becomes inoperable within one

month of the onset of symptoms. The first symptom is dysphagia for solid foods. Other early symptoms include regurgitations, emaciation, epigastric distress following deglutition, retrosternal heaviness, or a burning sensation, cough, attacks of severe pain, which may suggest angina pectoris. The roentgenologic, esophagoscopy and bronchoscopy findings are described. Delay in surgical intervention may be due to loss of time in trying to relieve the dysphagia by antispasmodics or antisyphilitic therapy, poor roentgenograms, or poor interpretation of esophagoscopy findings.

The contraindications to operation include first back pain, pain on percussion of the spinous apophyses, or fever and increased pulse rate indicating a large infected or ulcerated tumor. Neither weight loss nor debility are definite contraindications to operation. Absolute contraindications include pulmonary metastases, and metastases to the liver, peritoneum, or supraclavicular glands. Complicating abscess or fistula excludes the patient from surgical treatment, as well as cachexia persisting after 3 weeks of preliminary preparation. Also patients with cardiac lesions, bronchopulmonary lesions, and irreversible hepatic lesions are excluded. The physical condition of the patient counts more than actual age in determining operability, as some good results have been reported in patients over 70 years of age. Reversible cardiac and bronchopulmonary lesions may of course respond to proper treatment and leave the patient amenable to operation. Preoperative preparation includes alimentation, rehydration, administration of vitamins and calcium, and injections of prothrombin.

Other preparative procedures include oropharyngeal disinfection, esophageal disinfection, respiratory exercises, and administration of sulfadiazine and penicillin aerosols. Preliminary gastrostomy is indicated only when the tumor is very stenotic, situated high up in the esophagus, and supra-aortic, so that only a Torek operation or cervical excision can be considered. Jejunostomy is indicated only in the presence of a rigid stenosis in a greatly debilitated patient who cannot be properly fed, or in a patient whose cardiovascular system would not tolerate numerous intravenous perfusions following radical operation.

The classic technique for operation on cancer of the lower third of the thoracic esophagus is described, namely transpleural segmentary esophagectomy from the left side followed by low intrathoracic anastomosis. The advantages of Garlock's abdomino-thoracic approach are enumerated. Before closure of the abdomen he advises terminating the operation by instituting a jejunostomy so that the patient can be given nourishment immediately.

In operating on cancer of the middle third of the thoracic esophagus, 3 types of operation have to be considered, namely (1) the ideal operation or resection followed by high left transpleural intrathoracic anastomosis (Garlock and Sweet), (2) right or left esophagectomy by Torek a technique, and (3) resec-

tion followed by esophagogastric anastomosis from the right side necessitating a preliminary abdominal stage of gastrotomy. In the last type one may choose between three techniques, namely (1) the technique of Santy and Ballivet (2) the technique of Ivor Lewis, and (3) the technique of Herman Taylor. These are all described with the advantages and disadvantages of each. The three esophagogastric anastomotic procedures in use include anastomosis by invagination, button anastomosis and suture anastomosis.

Unusual routes of approach include the cervical the upper thoracic, and cervicoabdominal tunneling.

For cancer of the lower third of the esophagus, the procedure of choice is block resection of the tumor and its glands by the left transthoracic route with immediate restoration of continuity by esophagogastric anastomosis. For a tumor extending toward the cardia, an abdominothoracic incision may be considered. For cancer of the middle esophagus the Torek operation should be rejected for esophagectomy followed by high anastomosis. For cancer of the upper thoracic esophagus i.e. supra-aortic cancer opinions still differ as to the best method of approach. There is no satisfactory solution to this problem, for it is quite impossible to restore continuity. For these, fortunately rare tumors an attempt at the cervical approach, the Torek intervention or tunneling may be made.

The best methods of combating postoperative complications of the early and later postoperative periods are discussed. Among the early measures are antishock therapy, emergency evacuation for valvular pneumothorax, and bronchial aspiration for atelectasis. Infectious complications demand prompt application of sulfonamide therapy, penicillin and pleurotomy for evacuation of the purulent collection. The site of infection is not always easily established.

Cardiovascular complications are common and often beyond therapeutic help. Chylothorax may result from injury to the thoracic duct and constitutes a serious complication as does likewise, diaphrag-

matic hernia through an inadequately sutured diaphragmatic incision. Rupture of the sutures may be partial causing purulent pleurisy which requires drainage and occasionally an emergency jejunostomy. Partial fistulization is curable. Total rupture of the sutures usually occurs earlier and is fatal as a rule. Finally there are the late complications of stenosis of the anastomosis which if not too pronounced may respond to endoscopic dilatation. Late diaphragmatic hernia may be discovered accidentally and does not always require treatment. In button anastomosis the danger of fulminating hemorrhage due to ulceration of the aorta when the button is left *in situ*, has to be considered. Generally speaking complications are more frequent following high anastomosis and, also cardiac complications are more numerous in these cases. Crushing of the phrenic nerve may prevent traction on the anastomosis and facilitate healing of the phrenicotomy. Division of the two pneumogastric nerves may interfere with peristalsis and cause pyloric spasm. Postoperative gastric disturbances are not uncommon but these are temporary symptoms. Sweet was obliged to do a secondary pyloroplasty in one case. Patients should be warned not to lie down after eating as in this position regurgitation may be annoying. In none of Sweet's cases did partial or total transposition of the stomach into the thorax cause the slightest respiratory or cardiac disturbance. Sweet's statistical results are reviewed; they show a higher mortality for higher anastomoses. Low resections appear to give about the same end results as high resections. From 30 to 40 per cent of the patients subjected to low resection survived from 2 to 3 years. In 1945 Garlock reported 24 survivals without recurrence for periods of from 10 years to 1 month after operation. These results obtained in the United States are proof of the possibilities of surgery of cancer of the esophagus when practiced by trained specialists and trained assistants in medicine, bronchoscopy, anesthesia and radiology.

EDITH SCHANCH MOORE.

# SURGERY OF THE ABDOMEN

## GASTROINTESTINAL TRACT

**Technical Improvement in the Introduction of a Thread Guide and Its Recovery with an Electromagnet in Gastrostomy for Cicatricial Stenosis of the Esophagus** (Accompimento tecnico nell'introduzione del filo-guida e suo recupero con l'elettrocalamita nei gastrostomizzati per stenosi cicatriziale dell'esofago) **ANGELO CURATELLI** *Chirurgia*, 1946, 318.

The author has developed a new method for passing a thread through a stenosed esophagus emerging through a gastrostomy for the purpose of passing Tucker sounds for dilatation. He uses small iron balls beginning with a diameter of 1.5 mm. and up. These are bored with a bore which has one half side larger than the other so that it will be possible to anchor the knot of the thread used. He prefers to use a small metal chain such as is used for neck medals, to silk thread. Since the type chains available to him are not magnetic he attaches the iron ball to the end. He recommends that the chain be as flexible as possible. The smallest usable type that he was able to obtain measured 0.7 mm. in width. Chains up to 2 or 3 mm. may be used, the important point being that they be flexible. The length used is 50 cm. although from 20 to 30 cm. would be sufficient. He states that the use of the metal ball would be superfluous if these chains could be made of steel or other magnetic metal. The electromagnet is made of soft iron in the shape of a baton upon which is woven an insulated copper wire. This is mounted on an ebony handle and is furnished with an introducer. It is made in two sizes—5 mm. in width and 12 cm. in length and 5 mm. in width and 25 cm. in length.

The chain and ball are introduced through the nose and the length necessary to reach the external opening at the gastrostomy is measured so as to avoid its going on beyond the pylorus. The position is controlled with roentgenographic study. If there is difficulty in passage, small sips of water will usually help. When the ball has reached the stomach the patient is placed in the supine position so as to allow it to rest on the posterior wall. The electromagnet is then introduced under roentgenographic control and when it is near the ball the current is turned on. The ball is then easily extracted. Direct current is necessary for the magnet and the author uses batteries that are used with endoscopic instruments. The small magnet requires 4 volts, the larger 6 volts.

The roentgenographic control is recommended at the beginning but after the opening is somewhat enlarged the procedure can be easily carried on without its aid.

This procedure is recommended for persons who object to the constant wearing of the usual silk thread guide and the chain and ball are introduced at each dilatation. **LUCIAN J. FROMMELT, M.D.**

**Surgical Treatment of Cardiospasm.** **EARL B. HAY** *Ann. Surg.* 945, 127-34.

Instrumental dilatation of the esophagogastric junction may result in temporary symptomatic improvement in cardiospasm. This form of therapy may not be successful or may be contraindicated when there is marked tortuosity of the esophagus.

Numerous operative procedures have been used in the treatment of this condition with variable results. Techniques designed to enlarge the esophagogastric stoma have given the best results. The functional improvement is usually better than the change in x-ray appearance of the esophagus. The transabdominal approach is favored by most surgeons who believe that it is associated with less risk.

The author describes the technique employed and the results following transpleural cardioplasties in 17 patients. In none of these patients had the condition been significantly improved by dilatations. Symptomatic improvement and a marked reduction in size of the esophagus was observed postoperatively.

All cardioplasties were performed through a transpleural approach. The stoma was made large enough to allow reduction in size as the caliber of the esophagus decreased. The first three cardioplasties were performed in a manner similar to a Finney pyloroplasty and the others were carried out in a manner similar to a Heineke-Mikulicz pyloroplasty. The latter procedure was easier and more satisfactory.

The lower esophagus is mobilized and carefully inspected before the diaphragmatic hiatus is incised radially. The author stresses the importance of inspecting and incising any limiting bands in the diaphragmaticoesophageal ligament. This ligament appeared responsible for the esophageal obstruction in 5 patients. Detailed descriptions of several cases in which this ligament caused obstruction are given. The site of the ligament can best be inspected by enlarging the diaphragmatic hiatus, incising the peritoneum, and retracting the cardia of the stomach to the thorax. The esophagus and stomach are occluded by umbilical tapes. A longitudinal 4 inch incision is made through the esophagogastric junction. This opening is closed transversely in two layers. Approximately 100,000 units of penicillin are injected about the stoma. The stomach and new stoma are replaced in the abdomen and the diaphragm closed about the esophagus at a higher level. The chest is closed without drainage.

The only postoperative complications have been transient collections of serum in the pleural space of 4 patients. Hourly feedings of milk are begun as soon as the patient recovers from anesthesia. The Wangenstein suction pump is clamped intermittently for 3 days. The usual postoperative gastric diet is then provided.

All these patients were convinced of the greater relief afforded by operation as compared to instru-

mentation. Many patients exist for years with partial relief afforded by instrumentation without realizing the more complete and permanent benefit from this operation. ROBERT R. BIGELOW M.D.

**A Statistical Study of 112 Cases of Benign Gastric Ulceration** MAURICE FELDMAN *Am J M Sc.*, 1948, 215 13.

In a detailed study of a series of 7,300 ambulatory patients presenting varying digestive disturbances peptic ulceration was found in 1,266 cases. Of these 1,154 (86.7%) were duodenal lesions and 112 (7.3%) were gastric. An analysis of the duodenal ulcers having previously been reported the author here concerns himself with the statistics of benign gastric ulcer in relation to (1) incidence (2) site (3) age and sex, (4) duration of symptoms (5) symptoms and signs, and (6) recurrences.

The corpus and cardia were found to be involved in 74 cases and in 38 patients the pylorus was the site of the ulceration. By comparing cases seen during the period from 1937 to 1941 with those examined in the period from 1941 to 1946 the incidence of gastric ulceration was found to have increased from 0.8 to 1.2 per cent during the war years. There was a slight increase in the incidence of gastric ulcer in females during the years of war and gastric ulcers of short duration (or acute ulcers) were generally more common during this period. Recurrences were found to be less frequent in gastric than in duodenal ulcers. Pyloric ulceration was found in 38 of the 112 cases save for a greater prevalence of obstruction, the behavior of the pyloric lesions was like that of the gastric type. WAYNE F. CAMERON M.D.

**Clinical and Pathologic Studies of Papillary Mucous Tumors of the Stomach; Gastric Papillomas** (Beitrag zur Klinik und Pathologie der papillären Schleimhautgeschwulste des Magens (Magenpapillome) A. IKLE. *Helvet chir acta*, 1947 14 435.

Seven cases of papillary fibroepithelial gastric tumors, 3 in men and 4 in women are reported by the author. The lesion usually does not become manifest before the fifth decade and affects both sexes equally. The role of hereditary factors could not be established in the author's material.

Digestive disturbances accompanying the lesion do not allow its differentiation from an ulcer or a cancer. A tumor is palpable only in rare instances. Secondary anemia is often found and occult blood is nearly always demonstrable in the feces while hematemesis occurs with lesser frequency. Hypacidity or anacidity is present in practically every case. Roentgenologically filling defects without induration of the adjoining portions of the stomach wall and without interference with the peristalsis allow differentiation of the condition from a cancer. A spongy foamy pattern created by the papillary formation may sometimes be demonstrated in the roentgenograms.

Palpation of the exposed stomach may fail to reveal the tumor and therefore if the roentgenologic

findings are positive, an incision through the stomach wall is indicated. A simultaneous occurrence of a papilloma and a peptic ulcer was observed by the author in one case. A combination of a papilloma and a cancer has also been reported.

In view of the fact that papilloma of the stomach should be considered a precancerous lesion an extensive gastric resection is indicated.

Pathologically the structure of papillomas of the stomach resembles that of similar lesions in the large intestines and in the urinary bladder.

JOSEPH K. NARAT M.D.

**The Terminolateral Anticolic Gastrojejunostomy in Gastric Resection** (La gastro-digjunostomia termino-laterale antecolica nella resezione gastrica) NINO DELLA MIANO *Boll. Istit. Soc. piemontese chir.* 1946 16 431.

The author a student of Donati believes that antecolic gastroenterostomy should have a more widespread application than it now has. He feels however that the type of operation performed should depend upon the findings at the operating table.

Certainly in a patient with a wide transverse mesocolon with extensive zones showing no blood vessels one should not do an antecolic gastrojejunostomy. However in the presence of a retracted mesocolon or one not well developed or one with extensive blood vessels in which difficulties would be encountered in attempting to accomplish an opening wide enough one may constrict the blood vessels and thereby place the vitality of the transverse mesocolon in danger. In these cases the author suggests giving preference to the antecolic anastomosis without using the deprecated enteroenterostomy of Braun.

Gastric resection until recently was considered a grave intervention not without dangers for which a special technique was recognized. It was considered in the domain of an elected few and a high mortality was expected. At present however, with the perfection obtained in the technique with the adoption of local anesthesia, with the preparation of the patient by means of efficacious therapeutic measures (chief of which is blood transfusion) and with the measures at hand to combat complications it has become the common practice of any surgeon. The mortality has markedly decreased because of the improvements in both technique and therapy.

The principles of gastric surgery as expounded by Donati and followed by his students are to make the intervention as simple as possible to make use of any contribution which would make the execution of the operative act less difficult to reduce the immediate dangers and eliminate the conditions which may favor disturbance in function in the future.

LUCIAN J. FRONZONI M.D.

**Lipomas of the Large and Small Intestine.** ROBERT J. TENNER. *J. Lancet* 1948 68 12.

The author felt that a careful clinical and pathological study of submucous lipomas would be of

value because they so closely resemble malignant neoplasms of the bowel in clinical features.

The lipoma is the second most common benign tumor of the intestinal tract. The adenomatous polyp is first and the fibroma third. Submucous lipomas are more frequent than subserous ones and are also more apt to produce symptoms. Intussusception is a common and important complication of submucous lipomas.

Twelve cases of submucous and intramuscular lipomas of the large and small intestine are presented.

Pain was reported to be the most common symptom. It lasted 9 years in one case and only 2 months in another. Vomiting and constipation were present in 6 of the 12 cases. Diarrhea was not a common symptom. Definite weight loss of as much as 25 pounds was frequent. A mass palpable on physical examination was present in 8 cases; the tumor was demonstrated by the roentgenologist in every case. Ulceration of the mucosa covering the tumor was found microscopically in 11 cases. Occult blood in the stool was found in only 5 cases.

Seven of the lipomas were found in the colon and 3 in the cecum and 1 each was found in the jejunum and ileum. The average age of the 12 patients was 53 years.

Six of the lipomas were found in the submucosa, 3 had their origin between the inner circular and the outer longitudinal muscles of the intestinal wall, and 3 had their origin within the inner circular muscle. The author classifies these as submucous, intramuscular, intermuscular and subserous.

Treatment of the tumors is surgical either local excision with direct closure or anastomosis if the lesion is not too extensive. A resection of the segment of bowel containing the tumor is frequently done.

W. FOSTER MONTGOMERY, M.D.

#### Obstructive Lesions of the Small Intestine and Sigmoid Due to Irradiation. JAMES G. SPACKMAN. *Ann. Surg.* 948, 27.

The author presents a series of 5 case reports to emphasize the late clinical picture of obstruction due to irradiation. In each case the irradiation was for pelvic carcinoma. Patients who develop low sigmoid and rectosigmoid lesions soon after irradiation complain of cramplike abdominal pains associated with frequent small liquid stools containing mucus and blood. When the acute hyperemia and mucosal edema phase recedes and is replaced by cicatricial contraction, the physical signs of low sigmoid obstruction appear.

Since the terminal ileum is frequently in the pelvis signs of small intestinal obstruction may often appear earlier than those of obstruction of the low sigmoid.

It is important to remember that any patient who has received irradiation and later develops bowel symptoms (abdominal pain, nausea, vomiting and change of bowel habits) does not necessarily have a recurrence of the primary neoplasm. The stenosing obstructing lesion may be a late result of irradiation

amenable to proper surgery and with a more favorable prognosis. Abdominal exploration after appropriate study is indicated in all cases.

If the sigmoid lesion is acute and not due to scarring, a proximal colostomy may lead to regression by decreasing the edema and infection and eventually restoring the normal lumen. In dealing with all these lesions, the author believes a preliminary proximal diverting colostomy is indicated.

ROBERT R. BICKEL, M.D.

#### Neurinoma of the Small Bowel with Secondary Volvulus of the Ileocecum (Neurinoma del tenue e volvolo secondario dell'ileo-ceco-sacendente). LEONIDA MAMMOCCO. *Chirurgia*, 946 11: 32.

The author reports a personally observed case in which the patient presented a picture of recurring attacks of abdominal pain accompanied by mechanical ileus. Gynecological examination revealed a tender mass about the size of a fist in the right pelvic cavity which was displacing the uterus anteriorly. The patient was considered to have an ovarian cyst which had twisted on its pedicle. She also was found to have rheumatic mitral valve disease which had been present since early youth. She was now 65 years of age.

At operation she was found to have a volvulus affecting the distal ileum, cecum and ascending colon. There were 360 degrees of rotation in a clockwise direction. The involved bowel was distended and presented multiple punctate hemorrhages. A large loop of jejunum was also present, extending from front to behind the volvulus. This loop was stretched and attached superiorly at its mesenteric origin. It was stretched into the pelvic cavity by the weight of a tumor mass about the size of a large fist. It was white in color, granular and of rubbery hard consistency. The origin was from the convex margin of the bowel. About 15 cm. of jejunum were resected and an end-to-end anastomosis was performed. The volvulus was then easily reduced. A lymph gland was also removed for biopsy.

The postoperative course was stormy because of cardiac decompensation with improvement after the fifth day. Ten months later the patient had no symptoms. The microscopic diagnosis was neurinoma.

The literature is reviewed and some of the interesting points are brought out. Neurinoma or schwannoma, a tumor found frequently in the central and peripheral nervous system, has been found especially recently in various organs. It can be found in any organ which contains myelinated or amyelinated fibers furnished with a sheath of Schwann. Two morphologic types are described, the fascicular and the reticular. The digestive system is the most frequent site of a neurinoma outside of the nervous system.

The clinical picture may be that of intestinal hemorrhage, palpable abdominal tumor, intestinal obstruction, or inflammation simulating acute appendicitis with peritonitis.

The histological diagnosis is at times difficult and may resemble small spindle cell sarcoma. Two cases of neurinoma have been reported to have become malignant. The author however is inclined to believe that neurinomas are benign and that those which have been reported as having undergone malignant change were not neurinomas to begin with. Altogether 13 cases have been reported in the literature.

There are excellent illustrations depicting the anatomy as found at operation and also the histology of the tumor mass  
LUCIAN J. FRONZUTI, M.D.

**Delayed Results of the Surgical Treatment of Duodenal and Gastric Ulcer** (Resultados alejados del tratamiento quirúrgico de la úlcera gástrica y duodenal) RONOLDO E. PASMAN *Rev. As. Méd. Argent.* 1947 61: 883

Pasman reports the surgical results obtained in a series of 182 gastrectomies done in the period from 1940 to 1946, 36 were performed for gastric ulcer, 146 for duodenal ulcer and 11 for jejunal ulcer. The overall mortality was 4.6 per cent.

The author recommends subtotal gastrectomy as the elective surgical treatment for peptic ulcer and believes that gastroenterostomies are indicated only in exceptional circumstances. Extensive resection of the stomach is advised to avoid the formation of jejunal ulcers which did not occur in any case of this series. The author compared these results with those obtained in the period from 1929 to 1940—61 gastroenterostomies with a mortality of 10 per cent and 225 gastric resections with a mortality of 14 per cent.  
WILLIAM E. RICKETTS, M.D.

**Delayed Results of the Surgical Treatment of Duodenal and Gastric Ulcer** (Resultados alejados del tratamiento quirúrgico de la úlcera gástrica y duodenal) FEDERICO E. CHRISTMAN *Rev. As. Méd. Argent.*, 1947 61: 888.

Christman reports the overall results obtained in 673 patients subjected to gastric operations. One hundred ninety four had gastric ulcers, 331 had duodenal ulcers, 169 had juxta-pyloric ulcers and 5 had jejunal ulcers. There were also 47 perforated ulcers. The operations done were 120 gastroenterostomies and 394 gastrectomies, the total mortality being 5.6.

The author emphasizes the importance of pre-operative and postoperative care of patients to reduce the incidence of mortality after resection of the stomach. The treatment of peptic ulceration is considered primarily a medical problem and surgery is advisable only when there has been failure of the medical treatment. The main indication for surgery is perforation of an ulcer.

WILLIAM E. RICKETTS, M.D.

**Obstruction Due to Volvulus of the Colon** R. K. GILCHRIST *Arch. Surg.*, 1948 56: 79

The author reports his experience with 5 cases of acute obstruction. In 4 of the patients the condition

was caused by volvulus of the sigmoid and in 1 patient by volvulus of the cecum.

In older patients with acute obstruction caused by volvulus of the sigmoid there is usually a history of repeated attacks of constipation or of partial obstruction such history is absent in the younger patient. The patient usually does not appear as sick as one might expect with carcinoma. Abdominal distention may be pronounced but vomiting occurs late. The red blood cell count and the hemoglobin value are usually not much below normal. Pain over the dilated intestinal loop is particularly marked where the twist puts a pull or pressure on the root of the mesentery. This pain is very severe if there is much interference with the circulation.

In sigmoidal volvulus decompression may be obtained by placing the patient in the knee-chest position and doing a sigmoidoscopy. In very sick patients cecostomy is indicated to be followed by a resection of the sigmoid at a later time. Obstruction due to volvulus is not relieved by intestinal Miller Abbott intubation and suction.

Resection is the treatment of choice. When an interval operation can be performed resection and end-to-end anastomosis are feasible. Lateral anastomosis will give good results in some patients. Untwisting and fixation are unsatisfactory.

Volvulus of the cecum depends on the failure of fixation of the colon. Cecal obstruction is associated with early obstruction of the small bowel, vomiting occurs earlier, dehydration ensues, and the patient appears more sick than the patient with sigmoidal volvulus. Intestinal intubation with suction is useless. Early operation is indicated. Untwisting and fixation to the bottom of the pelvis and left pelvic wall is the safest method of treatment. If this procedure fails to give permanent relief, resection of the redundant bowel with lateral anastomosis is indicated at a second operation. If the bowel is gangrenous resection with transverse colon ileostomy is indicated.  
ROBERT TURELL, M.D.

**An Evaluation of the Clinical Management of Chronic Ulcerative Colitis.** EVERETT D. KIEFER. *Gastroenterology* 1948 10: 16

Chronic ulcerative colitis is discussed in relation to the three main objectives in management: (1) the control of symptoms and support of the patient's general condition; (2) the cure or arrest of the colitis; (3) the success or failure of the treatment in preventing chronic invalidism.

The first phase is stressed because 'specific therapy' has not been generally successful and therefore palliation and supportive measures have been important until the patient's natural resistance could bring about a remission or an arrest of the disease. Diarrhea is managed by a low residue diet which does not stimulate intestinal motility, and by kaolin or bismuth to slow motility and solidify the stools. Deodorized tincture of opium is of value in acute flare-ups of diarrhea and papaverine in dosages up to 6 gr. per day is used to control cramps.

and diarrhea. Bed rest and sedation are important measures. In acute emergencies complete starvation with intravenous alimentation is maintained for several days. Malnutrition is treated chiefly by a liberal diet, with proteins stressed in cases in which hypoproteinemia exists. Protein hydrolysates and intravenous amino acids are both of use in protein deficiency. Supplemental vitamins, particularly vitamins C and B complex, are important because of impaired absorption in ulcerative colitis. Electrolyte loss is corrected by intravenous saline solution plus glucose and when hypochloremia is marked an additional 10 gm. of sodium chloride per liter of intravenous infusion is used. Blood protein depletion and anemia are corrected by the liberal use of transfusions of whole blood and plasma. Iron in the form of ferrous sulfate or ferrous gluconate is used for mild anemia. Foci of infection or any other defect in the patient's general health receives specific attention. The emotional problems of the patient and his adjustment to the disease receive care.

In analyzing the effect of the "specific therapy" upon the disease the cases were divided into (1) the afebrile, nontoxic conditions of comparatively short duration which were usually relieved by nonspecific management (2) the febrile, toxic manifestations of ulcerative colitis, usually with complete involvement of the colon and (3) those cases in which there was extensive irreversible organic damage of the colon and rectum which made return to normal function practically impossible.

All patients who received "specific therapy" also received palliative supportive therapy. The effectiveness of the "specific therapy" was estimated by reviewing the hospital records of the patients and checking the effect of the treatment upon the diarrhea and the fever. The cases were first carried for a period of several days of nonspecific treatment to establish a base line.

Many specific agents were tried. The list included the diplostreptococcus vaccine of Bergen, sulfanilamide, neoprontil, sulfadiazine, sulfaguanidine, sulfasuxidine, sulfatbalidine, penicillin, streptomycin, fever therapy with intravenous typhoid vaccine, antimalarial therapy and antiallergic treatment. In almost all cases the results were poor or equivocal. Of the sulfonamides, sulfaguanidine gave the best response, but only 7 of 26 patients were definitely benefited by the treatment. Penicillin and sulfasuxidine were of greatest value as adjuncts to preoperative and postoperative management, and in controlling complications of the disease such as abscess or peritonitis. Antiallergic treatment was of questionable value but perhaps diets eliminating milk, wheat, eggs and fresh fruit are of some value.

A tabulation of the 537 cases in which the patients were treated medically and followed up for 3 years or more showed that the results were satisfactory in 46 per cent and unsatisfactory in 54 per cent of the cases. Medical management was successful in about two-thirds of the patients with the milder forms of the disease only one-third of the patients

with more severe forms of the disease obtained satisfactory results. Of 400 patients treated medically 99 eventually had to come to operation.

FREDERICK C. HORNEL, M.D.

#### The Surgical Treatment of Ulcerative Colitis. ROSS AND B. CATTILL. *Gastroenterology* 9:13, 10: 62.

Surgical treatment of ulcerative colitis accomplishes two things. First, it places the colon and rectum at complete rest by dysfunctioning them by diversion of the fecal stream. Second, it permits removal of the affected bowel when the infectious process cannot be arrested by medical means.

Medical management includes physical rest, a low residue nonirritating diet, and the use of antispasmodics to decrease intestinal contraction but none of these measures are as effective as ileostomy. Ileostomy can also be used for treatment of the dysfunctionalized colon if it is considered desirable since it permits satisfactory mechanical cleansing of the bowel, the use of antiseptics or antibiotics, as well as bland solutions or emulsions.

Over a period of 20 years at the Labey Clinic, 26 per cent of the patients under treatment for ulcerative colitis have been operated upon. A review of the fatal cases following operation demonstrates at once that two-thirds of the fatalities occur when operation is done as an emergency. The mortality will probably always be high no matter at what time in the period of observation of the acute fulminating case operation is decided upon, but it will be much lower if ileostomy is done within 2 or 3 days, during which time supportive measures, including the use of antibiotics and blood transfusions, are employed. There will also be a higher rate of complete remission of symptoms. This will permit closure of the ileostomy in 10 per cent or more of the cases.

The importance of malignant degeneration in patients having ulcerative colitis for many years has not been sufficiently appreciated. 7 per cent of all patients who had been operated upon developed it. Furthermore, of the group of patients who had had ulcerative colitis for 9 years or more, 1 in 3 had carcinoma—an additional reason for performing colectomy in long-standing cases, particularly in those in which the discharge of blood continues. Once the malignancy develops it will usually be found to be inoperable since early dissemination is frequently encountered.

One would not be justified in submitting patients to operation unless their condition subsequent to operation would be consistent with a reasonable activity both from the economic and the social point of view. In the early experience with ileostomy it must be admitted that its management was unsatisfactory. At the present time, however, the management of an ileostomy is no longer a difficult problem. The patients can be fitted with a temporary bag, such as the Travellor which will fit any ileostomy and it can be applied within 7 to 10 days of operation. Within a period of 6 to 8 weeks a permanent bag of the Rutzen type can be utilized. This bag is cemented to

the skin and prevents any ileal discharge from coming in contact with the abdominal wall which avoids all possible irritation. Furthermore, it can be worn equally well at night so that there is no soiling of the bed clothes.

Unfair comparisons of the mortalities following the medical and the surgical treatment of ulcerative colitis are frequently made. It should be appreciated that the selected group of patients submitted to surgery represents only the most serious and complicated cases—the medical failures. All physicians interested in this subject are willing to accept the fact that all patients with ulcerative colitis should be treated medically as long as they can be cared for satisfactorily. Approximately a fourth or less of the total cases are submitted to operation. While the mortality over a 20 year period was 22 per cent, during the last 3 years it has dropped to 4 per cent because of the experience gained in the earlier years.

STEPHEN A. ZIEMAN M.D.

**The Arterial Supply of the Distal Colon Pertinent to Abdominoperineal Proctosigmoidectomy with Preservation of the Sphincter Mechanism.**  
HARRY E. BACON and CALVIN H. SMITH. *Ann. Surg.* 1948, 127, 38

The arterial pattern of the colon has been a fundamental factor in determining the types of surgical procedures which can be successfully applied to that segment of the intestinal tract. In the surgery of the sigmoid and rectum the configuration of the arteries supplying these areas has been a particularly important consideration.

In the development of the present technique of abdominoperineal proctosigmoidectomy with preservation of the sphincter mechanism extensive precautions have been taken to insure the viability of that portion of the colon which is brought down to the perineum. The feasibility of the operation was first established in animals. In 71 cadavers the vascular supply of the colon and rectum was studied and the mobilization and transplantation of the viable bowel to the anus were proved to be practicable. In every operative case the pattern of the inferior mesenteric artery and its branches was noted by transillumination before any vessels were ligated.

The arterial supply to the segment of the bowel to be transplanted to the anus was observed by the same means after ligation of the inferior mesenteric artery. The distal point of viability was marked with a black silk suture, which facilitated its identification during the perineal phase of the operation. The distal point of viability was brought 7 cm. out side the anus. Viability was further assured by incising small vessels in the mesentery of the bowel and noting free bleeding.

This experience with abdominoperineal proctosigmoidectomy with preservation of the sphincter mechanism in 264 cases (from a total of 407 colon resections) may be considered to have been a method of study of the arteries to the sigmoid and upper rectum.

The configuration of the inferior mesenteric artery and its branches must be determined in each case by transillumination of the mesentery. Only in this way can the proper point for ligation be established consistently. Thus on the basis of studies of cases at operation the authors have confirmed the recommendation of both Sudeck and Hartmann that it is wise to observe in each patient the arterial pattern of the inferior mesenteric artery and its branches.

In the technique of abdominoperineal sigmoidectomy with preservation of the sphincters the last sigmoidal artery may be disregarded. The superior hemorrhoidal artery cannot be ligated below the origin of this vessel and allow sufficient mobility of the bowel to permit its being brought down to the anus without tension. As a corollary it is impossible in performing this operation to clamp the superior hemorrhoidal artery at the critical point of Sudeck.

The authors have been able to segregate those cases in which ligation may be made safely between the lowest two sigmoidal arteries from those in which ligation must be performed higher than the second lowest sigmoidal artery to assure viability, by the simple precautions previously described. Chief among these measures has been transillumination of the mesentery before and after ligation of the inferior mesenteric artery.

In an end-to-end anastomosis following resection of the sigmoid viability of each end must be assured.

In performing abdominoperineal proctosigmoidectomy with preservation of the sphincter mechanism the critical point of Sudeck need hardly be considered. Ligation of the inferior mesenteric artery must be performed above the lowest sigmoidal artery at least to permit the mobility of the colon necessary to bring it to the anus. Furthermore, the inferior mesenteric artery may be deliberately ligated much more proximally in cases in which more of the upward lymphatic pathway is to be removed or cases in which one is not completely satisfied with the competency of the circulation to that portion of the bowel to be brought to the anus. In the average case the most convenient place to ligate the inferior mesenteric artery is immediately below the first sigmoidal branch which can be recognized by the large anastomosis it forms with the left colic artery.

In selected cases of polyposis ulcerative colitis, diverticulitis, and lymphopathia venereum the rectum, sigmoid, descending colon, splenic flexure and a portion of the transverse colon have been excised. In these cases all branches of the inferior mesenteric artery have been ligated and the stump of the transverse colon has been brought down to the perineum. Viability has been maintained by the middle colic artery.

CHARLES BARON M.D.

**Haustrocecal Invagination (Invaginazione antra cecale)** RICCARDO SCENDRATZ. *Boll. Mem. Soc. piemontese chir.* 1946 16 463.

The author reports a case of haustrocecal invagination which was diagnosed at the operating table but the preoperative diagnosis was acute appendicitis.



tis. The cecum was near the hepatic angle and the lateral and anterior walls were invaginated into the lumen of the cecum. The base of the appendix was involved in the intussusception. The ileocecal valve was not invaginated. A loop of small bowel about 30 cm. from the valve was invaginated into the cavity formed by the invagination of the anterolateral wall of the cecum. The ileal loop was in good condition and contained hemorrhagic fluid. The wall of the cecum was markedly edematous.

The invagination was easily reduced and cecal plication extending into the ascending colon was performed. The appendix was removed and the lateral wall of the cecum was fixed to the lateral abdominal wall. The postoperative course was good.

The literature is reviewed and the conclusion was reached that there is no definite clinical picture and the etiology is obscure. Most cases are diagnosed as acute appendicitis. The author maintains, however, along with Russo, Sorensen and Angeli, that if the condition is kept in mind there are sufficient signs to enable one to make a diagnosis. The important points are:

The patient usually has had abdominal cramps many times the pain is not continuous there may be diarrhea with blood especially with cecocolic invagination, occlusive phenomena, meteorism, and vomiting. There is tenderness and muscle spasm in the region of the appendix during the attacks of pain. In between the attacks the abdomen is relaxed and at this time a small mass about the size of an egg with indistinct margins can be palpated. Most important is the fact that palpation of the mass frequently causes attacks of pain. While roentgenographic study with a barium enema is of value, it is considered too dangerous a procedure to use except in recent mild cases. Previous experience is considered of great help in making a diagnosis. To prove this point a second case is reported in which the diagnosis was made preoperatively. The diagnosis was confirmed by roentgenographic studies and also at operation. LUCIAN J. FROMMELT, M.D.

#### An Acute Condition of the Abdomen following Gangrene of the Wall of the Cecum (Addome acuto da gangrena parietale del ceco) ERIC BENNETT, *Chirurgia*, 1946, 285.

The author presents a case of gangrene of the cecum caused by carcinoma of the colon at the hepatic flexure. The patient had had a heavy sensation in the right iliac fossa for over a year with slight change in bowel habit manifested by poorly formed stool from time to time. He then developed a sudden attack of pain in the right iliac fossa which lasted for one-half hour. About 9 days later he had a second attack which lasted for 15 hours. Again 3 days later he developed a third attack. This time, however, the pain persisted and was accompanied by vomiting.

The patient was hospitalized, a diagnosis of acute appendicitis was made and operation was performed. At operation a gangrenous area in the cecum on the anterior wall was noted it measured 4 by 3 cm. The

appendix was free and hyperemic. The cecum was sutured to the anterior abdominal wall the sutures being placed beyond the gangrenous area. The abdominal wall was closed with through-and-through sutures of heavy silk. On the second day the gangrenous area was opened and this was followed by abundant fecal drainage. After 23 days the abdomen was explored, when a mass in the right hepatic flexure was found, about the size of a mandarin with no evidence of metastasis. An ileotransverse colectomy was performed. On the third day the patient had a natural bowel movement. However, on the sixth day he developed phlebitis in the right lower extremity with elevated temperature. This delayed the third operation which was performed after 35 days. At this time a hemicolectomy was performed and patient became ambulant after 16 days.

The pathologic report showed the mass to be an ulcerative infiltrating carcinoma. Two nodes removed in the right angular region showed a simple hyperplastic reaction.

The literature is reviewed and the first similar case was reported by Heischl in 1880. Seventy cases were reported up to 1945. Two theories prevail as to etiology one is that pressure caused by a stenosing lesion causes a rupture and the other is that pressure causes venous stasis and intraparietal hemorrhage, followed by focal necrosis and subsequent infection leading to perforation. The author states that this case represents the fifth case reported with successful outcome. LUCIAN J. FROMMELT, M.D.

#### Rectal Polyps: Diagnosis, 5 Year Follow Up, and Relation to Carcinoma of the Rectum. JAMES R. COLVERT and CHARLES H. BROWN *Am. J. M. Sc.*, 1945, 54.

The potential malignancy of benign rectal polyps is a controversial subject. One author found a variation of from 5 to 85 per cent in the malignancy index of rectal polyps, and other writers have contended that the probability of cancer increases with the number of polyps present, approaching 100 per cent in disseminated polyposis. Colvert and Brown observed 535 cases of rectal polyps at the Henry Ford Hospital, Detroit, with a follow-up over a 5 year period of 174 patients. In the present series, rectal polyps were found in 23 per cent of routine proctoscopic examinations, nearly three-fourths of these benign lesions were found in patients from 30 to 60 years of age, and 65 per cent of the patients were males.

In nearly all of the cases there were no symptoms due to the polyps, the large majority of patients being examined because of irritable colon distress. Proctoscopy was done in 21 cases because of rectal bleeding (not all of which was due to the polyp) and 9 patients were seen because of rectal discomfort which the authors believe, was not due to the polyp.

From the foregoing it is concluded that rectal polyps are essentially asymptomatic, and cannot be diagnosed except by proctoscopy. Barium enemas and, most particularly the double contrast

method of roentgenographic study, was found to be of importance in revealing colon polyps in addition to those found at proctoscopy.

When neoplastic changes were detected the malignancy was of low grade—frequently of grade 1 and never more than of grade 2.

Of the total number of 235 patients 176 had their polyps removed. Multiple polyps were demonstrated in 32 patients and 14 patients had recurrent polyps.

It was found that whereas size and shape were in no way related to the presence of malignancy ulceration was seen to occur seven times more frequently in malignant than in benign polyps. The total incidence of malignancy for a 5 year period in the patients whose lesions were removed was 8.4 per cent. Cancer was found to be present in 5.0 per cent of initial biopsies and 2.5 per cent of the patients subsequently developed carcinoma of the rectum. In the group of patients who did not have their polyps removed, the incidence of cancer of the rectum was 6.0 per cent. This last suggests to the authors that malignancy in rectal polyps either develops early or is present from the start and that there is no evidence that benign adenomas become malignant with the passage of time.

The authors advocate the removal of all rectal polyps, since the determination as to malignancy can not be otherwise made. The prompt removal of the majority of polyps in this series resulted in a 5 year cure without any major surgery in 13 of 14 patients with malignancy.

WAYNE F. CAMERON, M.D.

#### LIVER, GALL BLADDER, PANCREAS, AND SPLEEN

Biliary Tract Surgery in Passavant Memorial Hospital. THOMAS C. DOUGLASS and BENJAMIN F. LOUNSBURY. *Q. Bull. Northwest Univ. M. School* 1948 22: 21.

Seven hundred and twenty four operations on the biliary tract are reported among which were 540 cholecystectomies and 32 cholecystostomies. The mortality for all biliary tract operations was 5 per cent. In the cases of cholecystectomy the mortality was 1.5 per cent, and in the cases of cholecystostomy the mortality was 18.7 per cent.

Carcinoma of the gall bladder or bile ducts was present in 1.0 per cent of all the operative cases.

The omission of drainage did not seem to affect the frequency of complications, nor did it contribute to the mortality. Of the closed wounds 92.4 per cent healed by primary intention.

Twenty five per cent of the deaths following cholecystectomy occurred in patients 65 years of age or older but this group was only 7 per cent of the cholecystectomies.

SAMUEL KAHN, M.D.

Hepatic Abscess: Factors Determining Its Localization. THOMAS D. KIRKNEY and JOSEPH W. FERRER. *Bull. Arch. Path.* 1948, 45: 41.

It has been known since Serege's work in 1901 that the blood in the portal vein is relatively un-

mixed. The column from the superior mesenteric vein enters the right lobe of the liver and the column from the combined splenic and inferior mesenteric areas enters the left lobe of the liver.

The authors reviewed a series of 30,219 autopsies which disclosed 263 hepatic abscesses. Records for 229 only were complete and these form the basis for this report.

In 136 cases abscesses were present in both the right and left lobes of the liver in 75 cases the right lobe only was involved and in 18 cases the left lobe only was involved. The source of the infection is listed for each case.

Infection following common duct obstruction with septicemia was the chief cause of hepatic abscess. Eleven cases were due to abscess primary in the liver. Abscess formation in the left lobe alone was rare and in over half of the instances was due to direct extension of an ulcerating stomach lesion or infection of the lesser peritoneal cavity. There were 12 instances of abscess of the right lobe alone associated with inflammation of the gall bladder.

Hepatic abscesses following appendicitis tended to occur in the right lobe only unless there was an associated portal pyelophlebitis. If this occurs multiple lesions in both lobes usually result.

Abscess of the right lobe alone occurred in 27 patients in whom the primary focus of infection lay in an area drained by the superior mesenteric vein. Serege's rule appeared to hold with only one exception. In 4 cases the portal blood mixed sufficiently to result in bilateral liver abscesses.

The two lobes of the liver arise from separate outpouchings of the upper enteron and retain anatomic independence particularly with regard to the vasculature. There is evidence that the streams of portal blood coming into the lobes are of somewhat different origin. In man it is recognized that processes metastasizing via the superior mesenteric vein tend to go to the right lobe while processes coming from areas of the inferior mesenteric coronary and splenic veins go to the left lobe. The short portal trunk, low pressure, and sluggish flow may prevent complete mixing of the blood.

It has been suggested that there is a distinction between the nutritional environments of the two lobes in man. Since portal blood comes to the right lobe from the small intestine predominantly it may be richer in protective protein products of digestion than blood entering the left lobe. Separate catheterizations of the hepatic veins and study of the compositions of the blood leaving the right and left lobes would be of interest and might shed light on this problem.

ROBERT R. BIGELOW, M.D.

Cholecystectomy without Drainage (La cholecystectomie sans drainage). P. MALLET-GUY and R. KOPFER. *Lyon chir.*, 1947 42: 543.

The omission of drainage in 116 cholecystectomies was followed by no instance of hemorrhage, infection or biliary peritonitis. One patient died from pulmonary embolism, a mortality rate of 0.85 per cent.

The authors contend that omission of drainage following cholecystectomy permits better healing of the wound and a more rapid and satisfactory convalescence. They warn that it is essential to ligate the cystic duct with nonabsorbable material that no pathologic condition of the cystic duct may exist as it will jeopardize the security of the ligature, and that complete hemostasis of the gall bladder bed should be achieved with the electrocautery.

Forty-nine cases were followed up for a year or more. The results were classified as perfect in 44, good in 2 and mediocre in 3.

EDWARD W. GIBBS, M.D.

**Dystonias of the Common Bile Duct** (*Les dystonies de la voie biliaire*) R. GUILLET *J. chir. Par.* 1947 63 544.

Following a brief discussion of the anatomy and physiology of the triple system of sphincters of the adult choledochus, it is emphasized that dystonias of the common duct cannot be recognized clinically. Recent radiomanometric studies have shown hypotonia to be almost as common as hypertonia. There are only some 87 cases of hypotonia of the choledochus with radiomanometric findings available for study, namely the series by Mallet-Guy. Dystonia of the sphincter of Oddi is rarely primary and is usually associated with some pancreatic or biliary lesion. Sphincteric atony may produce pictures not only of pure angiocholitis, but also of medical jaundice recurrence following cholecystectomy or even chronic cholecystitis. Pancreatitis of obscure origin must be differentiated from a pancreatic reaction to atony of the sphincter of Oddi. In all of these cases, it is imperative to treat not only the consequences of the atony but the atony itself.

Caroli's apparatus reveals in cases of hypotonia in this region subnormal filling, evacuation and stabilization pressures. Mallet-Guy's apparatus shows a characteristic curve, with a rapid almost immediate fall in pressure and a subnormal stabilization level of from 8 to 6 cm. or even less. To be valid this curve must appear unchanged in at least two tracings. The essential roentgen feature is the wide or even gaping sphincter.

External derivation (cholecystostomy or choledochotomy) may relieve mild dystonias and affords opportunity for later correction of erroneous diagnoses, but many cases fail to respond to this method. Mallet-Guy suggests sympathetic intervention with unilateral or bilateral splanchnic infiltration or splanchnicectomy. The latter is most often used unilaterally by the subperitoneal route, is easy and safe and presents almost no contraindications. It can, moreover be performed at the same time as exploration of the bile tract.

Medical treatment, duodenal drainage or even splanchnic infiltration is rarely indicated except in cases showing a barium reflux. In atony associated with angiocholitis, a dilated choledochus, and in infected bile, external drainage is in order but choledochotomy carries the risk of duodenal reflux and is

best combined with splanchnic infiltration. Mallet-Guy avoids drainage unless the angiocholitis is very severe, preferring an immediate right splanchnicectomy. Very mild cases may respond to external drainage. When the complication is a calcareous cholecystitis, removal is indicated with eventual transcystic drainage or even splanchnicectomy. Cases of pseudorecurrence and atony in which both angiocholitis and atony have to be treated by drainage of the choledochus or of the cystic stump (frequently dilated into a "neo-gall bladder") require splanchnic infiltrations or right splanchnicectomy. Atony of the choledochus in medical jaundice likewise requires drainage and eventual intervention on the sympathetic system. In chronic pancreatitis with atony splanchnicectomy is doubly indicated.

Hypertension of the choledochus leads to stasis with resulting angiocholitis and dilatation of the hepatocholedochus, with final repercussions on the liver cells. Persisting hypertension may produce lesions which maintain and exacerbate the hypertension. Manometrically purely functional hypertension may respond to vagolytic drugs for a time, or persist and become worse because of local hypertrophy and sclerosis. The only reliable method of diagnosis is radiomanometry.

Hypertension may follow cholecystectomy, or chronic cholecystitis with or without exclusion of the gall bladder or lithiasis of the common duct. In chronic cholecystitis with exclusion of the gall bladder a supplementary sphincterotomy will be needed. Cholecystectomy constitutes only a part of the surgical problem in cholelithiasis. The condition of the sphincter of the choledochus will determine the immediate and late results. It is imperative in all cases, following removal of the calculi, to verify the state of the sphincter. Hypertension of the choledochus, especially if associated with sclerosis, may cause biliary fistula or recurrence following external derivation. Radiomanometry may disclose such hypertension as the cause of pseudolithiasis syndromes. Most frequently physiopathologic reverberations of hypertension may be observed in the gall bladder, pancreas or even in the liver cells. One may thus have to consider atony of the gall bladder, chronic pancreatitis, medical jaundice or sclerosis of the sphincter in association with hypertension. If sclerosis is present it must be determined whether it be primary or secondary.

Hypertension and sclerosis of the sphincter produce the same symptoms, but the former yields to indirect medical, or neurolytic methods, while the latter demands direct surgical intervention.

In hypertension of the choledochus or sphincter of Oddi, cholecystography reveals an abnormally tonic gall bladder with visibility of the cystic and even of the common duct following ingestion of a fatty meal. Only radiomanometry will confirm the diagnosis. Manometry by vesicular puncture will not suffice, but with puncture of the choledochus yields characteristic pictures with the Caroli apparatus, showing an abnormally high pressure (above 15 or 16 cm.)

for filling and stabilization. The Mallet Guy curve is abnormal and the residual pressure above normal. The roentgenographic findings are not pathognomonic. It is only their association or coexistence with radiomanometric findings which serves for diagnosis of hypertension of the common duct. The distinction between pure hypertension and hypertension with sclerosis is extremely difficult. The suspicion of even a beginning sclerosis justifies surgical intervention.

The treatment of hypertension of the choledochus consists of direct or indirect intervention on the sphincter. The former seems most logical. Mallet Guy's transduodenal sphincterotomy is done with the manometer *in situ* which aids in localization of the papilla, permits control of division of the sphincter and avoids complete severance which might lead to reflux and ascending angiocholitis. An infiltration of the vagus nerve during operation may serve to distinguish functional from anatomic hypertension. Even though medical therapy succeeds in a few cases a correct diagnosis is possible only with interoperative manometry. If the bile tract appears normal, radiomanometric study via puncture of the gall bladder is indicated with suture at the end of the operation—sphincterotomy without drainage. If cholecystectomy is indicated as for lithiasic cholecystitis the radiomanometric examination is done via intubation of the cystic duct, which likewise is sutured at the end of the operation, this is likewise sphincterotomy without drainage. However in the presence of angiocholitis, a drain is inserted into the common duct. Should choledochotomy be indicated following a previous cholecystectomy the drain is left in the choledochus above the level of the sphincterotomy for 1 or 2 weeks. Medical treatment constitutes an excellent adjunct to external derivation. Failures and recurrences are common after both external and internal derivation. The causal therapy is partial sphincterotomy. Although immediate results are encouraging, late results must await future evaluation.

In generalized atony unilateral right splanchnicectomy is recommended. The author prefers a direct attack with sphincterotomy under manometric control. Even though generalization of hypertensive phenomena might seem to justify vagotomy following anesthetic infiltration tests the possibility of sclerotic lesions indicates the direct attack. Only radiomanometric examination will permit localization of a functional disturbance and occasionally reveal its cause. This diagnostic method constitutes a great step in advance but it may be still further developed.

EDITH SCHANCHÉ MOORE.

**The Significance of the Choledochus Syndrome of Villard (Du déterminisme du syndrome cholédocien de Villard)** P. MALLET GUY and R. LACOUR. *Lyon chir* 1947 42 683

The triad of pain, fever and icterus proposed by Villard in 1913 as diagnostic of stone in the common duct was found to be present in 147 of 513 patients

complaining of biliary symptoms. Of these 106 presented the typical triad, 17 exhibited icterus and one of the other two symptoms, and 26 showed in addition to the typical triad either symptoms of angiocholitis or of prolonged persistence of the icterus. The groups are designated respectively the typical form, the subdeveloped form and the reinforced form. With the authors' methods of roentgenologic control and of manometric measurement of pressures in the bile passages, carried out during the operation itself, the presence of stone in the common duct was confirmed at operation in 61 patients who exhibited the syndrome of Villard, either in its typical form (46 cases), subdeveloped form (4 cases) or reinforced form (11 cases). In 14 more instances (12 typical and 2 subdeveloped) there was either positive certainty or at least strong likelihood that the common duct stone causing the symptoms had passed on into the duodenum. Thus there was a total of 75 cases (51 per cent) in which the cholelithic significance of the syndrome was confirmed either with certainty or with strong likelihood. Then there were 21 patients (14 per cent) in whom the presence of choledocholithiasis at one time or another was possible and 51 (35 per cent) in whom a hypothesis of choledocholithiasis seemed unlikely or impossible.

However although it is shown that there are a large number of conditions other than stone in the common bile duct which can reproduce in whole or in part the syndrome of Villard, the approach is still surgical. It is only when the abdomen is opened and the biliary system exposed that the manometric and roentgenologic controls can be carried out and only by means of these controls can the diagnosis of calculus or of any other pathologic condition be made with certainty. These controls can be applied in a few minutes by simple puncture. If the gall bladder appears to be normal or by intubation of the stump of the cystic duct if the gall bladder must be sacrificed. They will permit the detection of stones which cannot be palpated such as very small stones at the papilla of Vater which are masked by pancreatic reaction or disease. The methods also assure the removal of the obstruction and in cases in which stone is not present in the main biliary passage they will obviate an unnecessary choledochotomy. If biliary drainage seems to be the proper treatment for the condition present transcystic drainage may be simply substituted for the transcystic intubation.

JOHN W. BRENNAN, M.D.

**Pancreatic Calculi** E. L. ELIASON AND ROBERT F. WELTY. *Ann Surg.*, 1943 127 150.

Pancreatic calculi occur much more commonly than is generally appreciated. They can readily be recognized by roentgenologic examination. Surgical relief can be obtained and surgery is the procedure of choice in severe cases.

During a 10 year period from 1936 to 1945 9 cases of pancreatic calculi were admitted to the services of the senior author at three hospitals. All of the patients were explored. One patient died in this series.

a mortality of 11 per cent. Of the remainder only one was not definitely benefited, although some continued to have slight residual symptoms.

CHARLES BARON, M.D.

**Fibrocystic Disease of the Pancreas: A Review of 14 Cases.** DAVID PITT. *Med J Australia*, 1948, 1: 9.

The main clinical features of pancreatic fibrocystic disease are undernutrition, steatorrhea and chronic respiratory infection. The process is essentially a deficiency disease, the deficiency being in the external secretion of the pancreas. Familial and hereditary tendencies are recognized. The central theme of this report concerns the clinical résumé of 14 children manifesting this disease syndrome.

The initial symptoms were abdominal in about half of the cases and respiratory in the remainder. Bowel abnormalities were commonly noted often with bouts of diarrhea and the passage of large pale stool usually offensive in odor. Respiratory symptoms included cough present in some instances since birth. It was usually dry at the onset becoming moist only when purulent bronchitis or bronchiectasis supervened. Recurrent upper respiratory infections, bronchitis, and bronchopneumonia were almost invariable. Clubbing of the fingers was noted in 8 instances and cyanosis (a bad prognostic sign) was a common feature in advanced cases. Nutrition was uniformly defective being manifested by celiac facies, potbelly, wasted thighs and buttocks, poor muscle tone, and loss of subcutaneous fat.

In 5 of the 9 fatal cases enlarged and fatty livers were noted. Other workers have shown that defective pancreatic function is associated with fatty accumulation in the liver which in patients who survive gives place to a multilobular type of coarse cirrhosis.

The clinical diagnosis of fibrocystic disease of the pancreas should be made whenever the celiac syndrome is associated with evidence of lung disease. Estimation of the fat content of the stool should be carried out when clinical suspicion of the disease is aroused. The author mentions multiple diagnostic procedures designed to differentiate fibrocystic disease from celiac disease.

In untreated fibrocystic disease the course is steadily downhill. Just as the pancreatic lesion is progressive so is the pulmonary condition, and it is this which determines the death of the patient. When the early bronchitic phase is overtaken by the later infective phase the child is caught in an irreversible chain of events which leads to a fatal termination.

Treatment consists of diet, the administration of pancreatin, a generous vitamin intake, and control of the upper respiratory infections. The caloric intake must be carefully watched and a high caloric, protein rich, and restricted fat diet planned. Vitamin A should be given parenterally, the other vitamins orally. Penicillin and sulfonamide therapy is used for the recurrent pulmonary infections.

ORVILLE F. GUNDS, M.D.

**Cystadenoma of the Pancreas.** EDWARD E. JENKIN and NORMAN A. SAMUELS. *A. S. Surg.* 1948, 117: 153.

A cystadenoma of the head of the pancreas in a 31 year old female which had compressed the residual tissue of the head into a thin shell intimately applied to its posterior aspect, was successfully removed. The common bile duct, portal vein, and hepatic artery which were flattened out and bound to the posterior aspect of the mass were dissected free. Of note was the absence of any evidence of common duct or portal vein obstruction despite the marked compression of these structures. The location of this tumor in the head of the pancreas is uncommon in a lesion which in itself is infrequent. The mass was markedly mobile and because of this and the absence of any suggestive roentgenologic findings, a preoperative diagnosis of pancreatic cyst was not made. The mobility was due to an unusually displaceable duodenum and pancreatic head. It was noted, fluoroscopically that the duodenum was situated to the left of the midline but as there was no evidence of its compression or distortion the significance of the finding was not interpreted as suggesting a pancreatic lesion. The tumor itself was firm rather than cystic to palpation and on section there was a considerable fibrous stroma between the numerous small cysts with a large, central solid mass containing calcific deposits. The epithelium lining the cysts in some areas bore a marked resemblance to endothelium. It is interesting that despite this presence of calcium in the mass no shadow was cast on the roentgenograms even when the films were reviewed in retrospect.

The literature on cystadenoma of the pancreas was reviewed, and the various clinical, pathologic, and surgical features of the lesion were briefly discussed.

CHARLES BARON, M.D.

**Spontaneous Rupture of the Malarial Spleen.**

FALLS B. HERSEY and JOSEPH M. LUTZKE. *Ann. Surg.* 1948, 7: 40.

With the large number of malarial cases in the military service, traumatic and spontaneous rupture of the large friable spleen has become more common. The authors in reviewing the literature since 1917 have found 64 cases and prior to that time 73 cases were reviewed by Leighton. Many of these cases occurred in inoculated patients.

The authors give a detailed report of the case of a 37 year old veteran who recovered after surgical removal of a spontaneously ruptured malarial spleen.

In the series of 64 cases reviewed 39 occurred in inoculated patients and 25 in naturally acquired malaria patients. In the inoculation malaria the incidence of rupture varied from 2 to 101 to 0.3000 cases. Rupture occurred as early as the second day and as late as the fifteenth day of illness in this group. Traumatic rupture of the malarial spleen is very frequent (93 of 123 cases).

Spontaneous rupture of the spleen in naturally acquired malaria is rare. Although rare, prompt diagnosis and treatment will save persons who would

otherwise die. Spontaneous rupture of the spleen has been reported with all species except *Plasmodium malanæ*, the great majority of ruptures occurring in cases with *Plasmodium vivax*.

The spleens were enlarged averaging from 450 to 500 gm. Hemoperitoneum was present in all but one case and was almost uniformly due to rupture of the capsule. The pathological descriptions of the spleens were similar and followed the description of the spleen of acute malaria. The authors emphasize how reticular and endothelial hyperplasia obstruct venules and sinuses and cause the interstitial and subcapsular hemorrhages that often lead to rupture.

The mechanism of rupture may be due to (1) local lesions as points of weakness (2) increase of tension due to hyperplasia and engorgement and (3) compression by the abdominal musculature.

Arteriosclerotic alterations in vessels adhesions and thickening of the capsule, interstitial and subcapsular hematomas, focal necroses changes in fibrous tissue or blood vessels, and great increase in tension within the capsule all may be responsible for the rupture. Vomiting diarrhea defecation and straining all may be of significance.

The signs and symptoms are chiefly those of (1) circulatory effects of acute blood loss and (2) local abdominal effects of bleeding and rupture. The authors call attention to the different clinical picture in luetics and nonluetics. The luetics were older and afebrile they had negative abdominal findings and acute malaria and usually died less than 2 hours after onset of the symptoms often with no complaints of pain. All but one of the non-syphilitic had pain and collapse. The onset of rupture was sudden and clear in all but 2 cases. The pain was severe generalized and worse in the left or upper abdomen. Kehr's sign was present in only 6 cases. Epigastric abdominal spasm tenderness slight abdominal distention and persistent left flank dullness were the chief abdominal findings. The spleen was palpable in only 5 cases.

Preoperative malarial smears were positive in all 8 cases in which they were made. The white blood counts were low or only slightly elevated. In 5 cases the preoperative hemoglobin was low.

The diagnosis was made preoperatively in only 7 cases and suggested in 2 others. Perforated peptic ulcer intra-abdominal hemorrhage ruptured hollow viscus intra-abdominal abscess and ruptured uterine tumor were other diagnoses listed. Cerebral malaria and cardiovascular accidents were the most frequent diagnoses made when malaria was known to be present.

The absence of an ulcer history the normal leucocyte count plasmodia in the smear a not exceedingly rigid abdomen, absence of free air under the diaphragm and physical findings and symptoms pointing to the left upper quadrant are all helpful in differentiating a perforated ulcer.

In the absence of shock and presence of malaria one must consider perisplenitis splenic infarction splenic abscess, and volvulus of the spleen.

The treatment is always surgical as this complication is almost always fatal. Prompt restoration of the blood volume is essential. The operative mortality varies from 26 to 33 per cent in the natural and inoculated malaria. Accurate early diagnosis results in lowered mortality and reduced postoperative complications. Better medical and antishock treatment may improve the surgical mortality.

In this series 5 patients died and 14 survived. Splenectomy was the treatment in every successful result. Generous blood transfusions have been used recently with success. Adequate medical treatment of the malaria is essential.

ROBERT R. BIGELOW M D

**Hemolysis by Splenohemolysin as Manifestation of Splenopathy of Regressive Character** (*L'emoiosi da splenocemolisi come manifestazione di splenopatia a carattere regressivo*) C. TARANTINO and F. PASQUINELLI *Sperimentale* 1947 98 563

Various theories favoring or criticizing the hypothesis of the existence of hemolysins of splenic origin are discussed by the author.

In patients with splenic disorders a ligation of the splenic artery may replace splenectomy whenever the size of the organ adhesions, or general condition of the patient preclude removal of the organ.

A diagnosis of Banti's syndrome was made in a 54 year old man with an enlarged spleen hemolytic icterus and ascites. A ligation of the splenic artery and omentopexy were performed. The histologic examination confirmed the diagnosis of Banti's disease.

Two months after the operation the patient again developed hemolytic jaundice.

The author concludes from his observations that the spleen secretes a hemolytin which may display its effect in remote areas.

JOSEPH K. NARAT M D

## MISCELLANEOUS

**The Pneumoperitoneums of Unknown Origin** (*Les pneumopéritoneaux d'origine inconnue*) GEORGE PROVOT and LUCIEN LEGER. *J. chir., Par* 1947 63 632

Two cases of pneumoperitoneum are reported. The first patient was a 30 year old female who suddenly experienced violent pain in the epigastric region. Under bed rest the pain disappeared except that there was pain on coughing which radiated to the right shoulder. Roentgen examination disclosed pneumoperitoneum. (The patient had been taking baking soda for about 2 weeks for digestive distress.) Some pain was experienced on palpation in the epigastric and right hypochondrial regions. Since the condition did not change in 2 days an exploratory operation was decided upon. This was done under spinal anesthesia. Nothing abnormal was found except the air in the peritoneal cavity however during the operation the patient suffered cardiac and respiratory arrest (anesthesia accident) and despite the assistance of a respirator died 4

hours later. At autopsy the duodenum appeared somewhat flaccid the external surface was ecchymotic and the inner surface was of a dark brownish color. Nothing else seemed to be abnormal.

The second case was that of a 33 year old man. About 2 hours after the evening meal he experienced a sudden violent abdominal pain. This was located mostly on the left side but radiated to the right shoulder. The abdomen became enormously dilated but did not contract. The liver dullness completely disappeared. Palpation provoked a rather severe pain in the right iliac region. Aside from a lead line on the gums and the pneumoperitoneum no other abnormality could be found however about a month previously he had had another such pain attack, this time on the right side with the pain radiating to the left shoulder, and he had vomited and suffered a temporary retention of gas and feces. This time also he had been hospitalized and pneumoperitoneum had been demonstrated roentgenologically. In the second attack operation was decided upon and upon opening of the peritoneal cavity there was a gush of stale smelling gas. The intestines were also somewhat dilated and in the region of the appendix there was a small pool of a slightly turbid fluid with the same stale unpleasant odor as the gas. The fluid proved sterile and there was no explanation for its origin or for the origin of the pneumoperitoneum. Two months later the patient had another attack of the same general character as the preceding ones, and died without consulting a physician. There was no autopsy.

In connection with these 2 cases the authors reviewed the literature on the subject of pneumoperitoneum and were able to gather 53 fairly comprehensive case reports. In 31 of these operation was done, 20 patients recovered and 11 died. The remaining 22 patients were not operated upon and all recovered except 1 who appeared not to have died of the abdominal condition. These figures do not argue in favor of exclusively medical treatment of pneumoperitoneum however they emphasize the urgent need of intense study of the so-called idiopathic form of pneumoperitoneum and the danger of a priori reasoning.

In fact no one form of etiology seems to explain all cases some seem reasonably well explained on the basis of a microperforation of the stomach or duodenum, or of tubal antiperistalsis in the female or of a perforation into the peritoneal cavity of a subcutaneous or mediastinal emphysema or of the rupture of cystic pneumatosis or of manual perforations of the uterus or bladder. Yet the abundant occurrence of these etiologic possibilities (except perhaps the cystic pneumatosis) when compared with the rarity of spontaneous pneumoperitoneum, does not argue for any close relationship among them, and the authors believe that it is best to regard pneumoperitoneum as resulting from a number of different etiologic factors until such time when something more can be learned of its pathogenesis.

JOHN W. BRIDGMAN, M.D.

**A Contribution to the Study of Mesenteric Cysts**  
(Contributo allo studio delle cisti del mesentero)  
GIOVANNI D'ENRICO. *Riforma med.*, 1947, 61: 333

A review of the literature is presented and mesenteric cysts are classified according to Bonaccorsi into lymphatic, embryonal, and parasitic types. The author then gives a description of all these types and discusses their etiopathogenesis and pathological anatomy. Two case reports are presented one of a lymphatic cyst found while operating for an ovarian cyst both cysts were excised. The second report was of a dermoid cyst. The clinical signs were described they being essentially those of a freely movable mass in the right side lateral to the umbilicus.

The number of reported cases according to Coster Hellerer and Escue is less than 400 (1946).

LUCIAN J. PROSDORI, M.D.

**One Hundred and Thirty-Seven Consecutive Combined Abdominoperineal Resections without Mortality** THOMAS E. JONES, JOHN R. ROBINSON, and GARBER B. MEARS. *Arch. Surg.* 1948, 56: 109

Since the treatment of carcinoma of the rectum is still a controversial subject in the medical literature the authors presented a study of 137 consecutive combined abdominoperineal resections of the rectum without operative mortality as a contribution to the growing weight of evidence in favor of the one stage combined abdominoperineal resection, as contrasted with operations of lesser magnitude. A Miles type of operation was performed in all cases under spinal anesthesia. The wounds were closed primarily with alloy steel wire sutures. No sulfonamides or antibiotics were employed in the preparation of the patients or at the time of operation.

Of interest is the observation that 28 of the patients complained of hemorrhoids within a period of about 6 months prior to the diagnosis of a malignant growth, and in 75 per cent of these hemorrhoidectomy had been performed in the same period.

There is no standard set of symptoms for rectal carcinoma the patient's history alone is unreliable. The duration of symptoms before a proper diagnosis is made depends on 3 factors: (1) the patient's neglect in not consulting a physician before the condition is in a far advanced stage (2) disregard of good medical advice and (3) improper diagnosis of the condition in its early stages. The greatest number of patients in this group (75 per cent) had symptoms for 9 months or longer, only 25 per cent had symptoms from 1 to 9 months.

A palpable rectal lesion was elicited on digital examination in 120 patients (87 per cent) in only 18 patients (13 per cent) was a sigmoidoscopy required in making the diagnosis. The sigmoidoscope was otherwise utilized to determine the amount of circumference of the rectum involved by the lesion, the amount of fixation of the lesion, the character and type of ulceration of the mucosa, and the distance of ulceration from the mucocutaneous junction.

Biopsy was carried out only once in the present series. The authors are not of the opinion that bi-

opsy is necessary since the diagnosis can be made on gross appearance of the lesion and it may even be misleading. Often biopsies of superficial tissue do not reveal the disease when a biopsy of tissue from deep in the tumor would.

Preoperative fixation was noted in 41 cases (29 per cent) but fixation at operation was encountered in only 38 (about 27 per cent). In 14 of these it was necessary to remove a portion of the prostate with the rectal growth. Radium seeds were implanted in to this prostatic bed or in the surrounding tissue in 6 of the 14 patients. Nodules in the liver were encountered in 9 cases. Metastatic glands were found in 4 patients in whom the operation was performed primarily for the comfort of the patient.

The most important indication of the patient's condition during operation was the pulse rate. Increases in pulse rate were viewed with much more alarm than drops in blood pressure.

In 3 cases two separate lesions were found in the same specimen: the lesions in 2 patients being an adenocarcinoma in the rectum and a squamous cell carcinoma at the mucocutaneous junction. Mucosal polyps separate from the malignant lesion were found in 30 cases (22 per cent). In 8 of these there were multiple mucosal polyps. The pathologic classification and the number of the lesions were: 125 adenocarcinomas (90 per cent), 5 medullary carcinomas (4 per cent), 4 squamous cell carcinomas (3 per cent) and 4 benign papillomas with malignant change (3 per cent).

The entire series of lymphatic nodes was involved in 7 cases (5 per cent). The perirectal fat only was involved in 49 cases (35 per cent). The fat and nodes were both involved in 67 cases (40 per cent). In 15 cases there was no involvement of the fat or nodes. In the smallest lesion there was no involvement of the fat but there was involvement of 14 per cent of the nodes; in the largest lesion there was involvement

of fat but no involvement of nodes. Hence the relationship of the size of the lesion to its spread to the surrounding structures remains undetermined.

The authors believe that the one factor responsible for a marked reduction of complications is the employment of alloy steel wire sutures through all layers in closing the abdominal wound. Infection of abdominal wounds occurred in only 3 cases (2 per cent). The other factors in lessening complications were (1) the avoidance of stay sutures of any type and (2) the avoidance of suturing the serosa of the bowel to the peritoneum or the abdominal wall.

An uneventful postoperative course, except for disturbances of the urinary tract, occurred in 68 cases (48 per cent). Mild obstruction of the small intestines or paralytic ileus developed in 13 cases (9 per cent) and was relieved in all cases but one by the use of the Miller Abbott tube enterostomy for relief was required in the one exception. Pulmonary infarction occurred in 2 patients and atelectasis in 4. Mild infection of the posterior wound occurred four times. A fistula in the posterior vaginal wall also occurred in 4 cases. Infection of the urinary tract and retention of urine were very troublesome and most consistent.

The reviewer desires to call particular attention to the departure by the authors from the generally accepted preoperative use of sparingly absorbable sulfonamide drugs and the omission of biopsies.

In the discussion of this paper MADDOCK stated that while cancer is a disease that is never treated too early and seldom too radically, yet he is dissatisfied with the opinion that all rectal carcinomas should be subjected to a Miles procedure with the consequent loss of the anal sphincteric control. It is his belief that in patients with liver metastases the function of the sphincter should be preserved as the length of life in these patients is relatively short.

ROBERT TURELL, M.D.



# GYNECOLOGY

## UTERUS

A Method of Study of the Uterine Canal. W. B. NORMAN. *South. Surgeon* 1947 3: 885

This article deals entirely with the diagnosis of submucosal myomas, polyps and malignancy of the fundus of the uterus by means of hystero-grams and direct observation. Since the uterus is such a common site of polyps and submucosal myomas it would seem that a hystero-gram should be almost a routine requirement in case of irregular uterine bleeding.

The objections to the use of iodized oils are overcome by the use of rayopake. This product is an opaque contrast medium containing an organic iodine compound and a polymetric form of alcohol. The author uses a plastic cannula which is semipliable and nonopaque. The technique of injection is presented.

The second method of study is by direct vision and indirect vision. This is more useful in detection of carcinoma of the fundus of the uterus. The instruments consist of a transparent plastic sheath and an optical instrument which is inserted into the plastic tube. Some type of anesthesia must be given. The cervical canal is dilated and the plastic tube with the optical instrument is inserted into the uterus. If it is sufficiently evident that carcinoma is present, then curettage is not necessary. If there is doubt, curettage should be performed.

This method of study of the uterine canal, by hystero-gram with rayopake direct and indirect vision combined, will aid greatly in the diagnosis of benign and malignant growths of the uterus, with greater safety to the patient. T. FLOYD BELL, M.D.

Contribution to the Study of Uterine Cysts (Contributo allo studio delle cisti dell'utero) PIETRO QUINIO. *Riv. Ital. g. n.* 1947 50: 3.

The author divides these rare cysts into true cysts, in which a preformed wall covered by epithelial or endothelial tissue delimits a closed cavity entirely or partially filled with varying material and pseudocysts in which the wall of the abnormal closed cavity consists of connective and fibromuscular tissue or of tissue proper to a neoplastic, fibromyomatous, or sarcomatous formation which has undergone cystic transformation. He classifies true cysts into retention cysts, lymphatic cysts, dermoid cysts, embryonal cysts, which include those from ectopic residues of Wolff's bodies, remnants of the Malignant-Gartner canal, and anomalies of development of Mueller's ducts; cysts due to epithelial dysplasias and discovered at various periods in life; and aberration cysts caused by invagination of the peritoneal epithelium. He reports 3 cases of histologically proved true cysts of the uterus: the first was classified among those of muellerian origin and the second was considered as a peculiar type of lymphatic cyst.

In the first case the large cyst had the appearance of an accessory uterine cavity. Because of its site and the absence of any particular structure as the cyst did not originate from remnants of Wolff's bodies or of the Malignant-Gartner ducts, or from inclusion of epithelial elements of the peritoneal serosa or endometrial aberrations (the cyst was clearly separated from the uterine cavity by a special layer), it seemed evident that it had originated from remnants of Mueller's ducts. This had taken place by means of diverticula which had lost their primary connection with the mucosa or defects of scissure or of fusion of the two ducts which had remained enclosed in the muscular layer of an apparently well formed uterus. The cyst had nearly all the anatomic-histologic characteristics of muellerian cysts: median location, delimitation by the fibromuscular walls like those which should constitute the true walls of the muellerian canal, internal lining with cylindrical, cubical flat and stratified pavementous epithelium with well marked deformities, the presence of numerous true papillae, the presence of smooth fibromuscular cells in the wall of the cyst, and, finally, a viscous serosanguineous fluid content. Among all these characteristics the true papillae and the evident deformities of the lining epithelium are those which justify the classification because they serve to differentiate cysts of muellerian origin from those due to remnants of the ducts of Wolff and of Malignant-Gartner.

In the second case the large cystic cavity was made irregular by the presence of remnants of old destroyed septa, the walls of which were lined by an interrupted layer of endothelial elements resting on a thick lamina of tissue having a fibrillary structure rich in lymphatic partly dilated spaces and muscular fibers beyond which the uterine musculature was thinned by the distention of the cyst under the pressure exercised by its liquid contents.

From the clinical point of view the two cases offered no help for the diagnosis, the difficulties of which are practically insuperable because of the absence of specific history and of subjective and objective pathognomonic data. In fact, even if the objective examination suggests a genital cystic tumor it will not always be easy to determine whether it is an ovarian or paraovarian cyst, a hydrosalpinx or a hematosalpinx, or a uterine tumor and in this case whether it is a cyst or a pseudocyst. In general, cysts and pseudocysts of small size pass unobserved or are mistaken for fibrous nodules, while those of marked size are confused with more common uterine or paraovarian conditions and even with pregnancy. But except for the possibility of confusion with pregnancy and the consequences which may derive from it, missing the correct diagnosis is of little importance because the conditions which simulate uterine cyst lead to the same surgical treatment. Surgery is absolutely indicated because the evolution of these

benign tumors is not exempt from possible serious complications which include rupture suppurative and torsion of the uterus and grave cardiac disturbances in exaggerated development of the cyst. According to the findings the intervention may consist of subtotal or total hysterectomy or simple removal of the cystic formation generally if the operation is performed in time before the occurrence of complications it does not offer any difficulties and carries a favorable prognosis

RICHARD KEMEL, M D

**Ectodermal Invasion of the Myometrium** (L'invasione ectodermale del miometrio) LUIGI DE GIORGI  
*Arch ostet gin* 1947 52 211

The terms ectodermal invasion and chorionic infiltration are not synonyms, but refer to different anatomical substrata and have a different meaning. By the latter the author means various morbid processes such as placenta accreta, and he defines the former (in accord with Poso) as that morbid process characterized by dissemination of derivatives of the chorionic ectoderm in the maternal structure to such an extent that, even when the uterus is completely freed of the ovum, a large part of the element remains in the placental area. This morbid process is called syncytial endometritis by Ewing and atypical chorioepithelioma by Marchand.

The author reports the case of a multipara, 45 years old, who following an amenorrhea of 2 months expelled from the uterus a mass (a vesicular mole) which was followed by a persistent metrorrhagia. After surgical intervention i.e. total abdominal hysterectomy and bilateral adnexectomy the patient recovered completely. Macroscopically the uterus revealed on the posterior wall toward the fundus an area irregular in shape and dark red in color which was considered to be the nidus of the ovum. Microscopically the dominant features were ectodermal elements, mostly in colonies, occasionally scattered and characterized by zonal disposition with extension in the myometrium, nuclear and protoplasmic areas of regression and regeneration leucocytic infiltration and glandular elements. These areas were defined by the author as areas of endometriosis.

In the interpretation of the case, the most important facts to consider are the quantity quality and extension of the ectodermal elements and the complete absence of any vestige of villi. This excludes the possibility of postabortive endometritis.

The theory that the ectodermal elements suggest a neoplastic growth is refuted by the absence of atypical cells which usually invade the chorioepithelomatous centers and which represent active or degenerative centers of the blastomatoses. It is also to be noted that there is a lack of inflammatory reaction superimposed on the ectodermal elements. Another important observation is the predominance of various stages of protoplasmic and nuclear degeneration which suggests the regressive characteristics of the lesion. The lesion therefore must not be regarded as a syncytioma or syncytial endometritis which

is a transitional lesion with definite neoplastic characteristics. Correct interpretation of the case leads to correct therapy. In this case radical surgery was suggested by the multiparity of the patient and the uterine metritis as disclosed by the histological examination of the uterine scrapings.

Chorionic invasion of the endometrium signifies a uterohorionic pathological process found at any stage of pregnancy. It is characterized anatomically by a quantitative abundance of chorionic elements interspersed with areas of degeneration in the decidua basalis and in that part of the myometrium corresponding to the situs placentaris. Inflammatory changes and phenomena of necrosis and hemorrhage are also present. It is a regressive process and not a neoplasm of the chorioepithelomatous type.

JOSEPH M. A. PAPP, M. D.

**Atypical Endometrial Hyperplasia Simulating Adenocarcinoma.** EMIL NOVAK AND FELIX RUTLEDGE. *Am J Obst* 1948 55 46

The purpose of this article is to call attention to a group of benign hyperplastic lesions of the endometrium which may be and often have been mistaken for adenocarcinoma. While these lesions are actually hyperplastic in a general pathological sense they are very different in their histologic characteristics from the ordinary type of benign endometrial hyperplasia. The latter term has come to have reference in gynecologic literature to the Swiss-cheese type of endometrium characterized especially by disparity in the size of the glands some being large and cystic, and some small with a rather abundant, compact stroma. The authors emphasize that the histologic picture presented by the ordinary Swiss-cheese hyperplasia does not in the slightest degree resemble that of adenocarcinoma. Also the ordinary hyperplasia as observed during reproductive life has no tendency toward malignant transformation.

The histologic appearance of any part of the endometrium is determined not only by the hormonal influence to which it is subjected but also by its own degree of sensitivity or refractoriness to the hormones in question. The degree of maturity or immaturity ripeness or unripeness of the endometrium appears to be the most important factor in determining the degree of its receptivity to the ovarian hormones. The simple type of Swiss-cheese hyperplasia does not represent the only abnormal endometrial pattern which may be produced by excessive or prolonged estrogen stimulation. This atypical hyperplasia may be fairly uniform throughout the endometrium but more frequently the atypical lesion occurs in one or in many localized areas of an endometrium which otherwise presents an obviously benign Swiss-cheese picture. The authors believe that these abnormal cancerlike areas represent different degree or types of estrogen effect upon areas which respond differently to the same estrogen growth stimulus. This conclusion carries with it also the connotation that such areas are not histologically indicative of malignancy.

Some of the atypical proliferative patterns which may lead to the incorrect diagnosis of carcinoma are given as (1) increased number crowding and moderate atypicalness of the glands (2) stratification, abnormal staining, and atypical morphology of the epithelium and (3) the presence of squamous plaques in the walls of the glands, and occasionally on the surface. These atypical patterns are discussed and illustrated.

The material forming the immediate basis for this study consisted of a group of cases, 44 in all, which showed atypical hyperplastic changes which might readily be mistaken for adenocarcinoma, and were selected from a considerably larger group exhibiting less pronounced atypical pictures which few would interpret as malignant. **JOHN R. WOLFF, M.D.**

**Ultimate Results in Irradiation Treatment of Cancer of the Uterine Cervix** (Sui risultati a distanza del trattamento atimico del carcinoma del collo dell'utero) **EMILIO ROBERTI, Ginecologia, Tor., 947**  
3 306

The author reports on 92 cases in which irradiation treatment was given for cancer of the uterine cervix in the period from January 1, 1934 to December 31, 1942. Eighty of these could be followed up from 3 to 2 years; those not followed up were simply figured as deaths. According to the Geneva classification: 22.8 per cent of the cancers were adjudged as in the first stage, 23.9 per cent in the second, 51 per cent in the third and 2.1 per cent in the fourth. By this classification the first two stages are regarded as operable and the last two as inoperable. The youngest patient was 31 years old and the oldest 66. Those regarded as operable were given the combined treatment with surgery and irradiation; the rest were given irradiation therapy alone. The latter method consisted of endocervical (10 mgm.) and vaginal (15 mgm.) applications of radium for a period of 8 days (total 4,800 mgm. hours) and then roentgen irradiation in doses of from 800 to 1,500 roentgens per field. There were two anterior and two posterior fields (rarely two trans-ischiatric fields) for a total dosage of from 3,200 to 6,000 roentgens. This course was repeated a second and third time at later periods.

After a period of 5 years' observation 60 per cent of the patients in the first stage, 50 per cent in the second stage, 21.6 per cent in the third stage and none in the fourth stage were still living. In those under observation for less than 5 years there were 6 in the first stage (3 living, 2 dead, 1 lost to follow up), 6 in the second stage (1 living and 5 dead) and 10 in the third stage (3 living, 6 dead, 1 lost to follow up). There were only 2 patients who were in the fourth stage: one of these died in 5 months and the other died a year later. Of course not all of the decedents died of their cancer; at least one is known to have died in an air raid and another of a pulmonary infection.

Thus, among the total 92 patients there were 25 with 5 year survivals and although one did die after

6 years and another after 8 years, the results obtained at this clinic (University of Torino, Italy) are regarded as exceptionally good.

The author regards the most important field for investigation at this time as that of earlier recognition of cervical cancer. **JOHN W. BRENNAN, M.D.**

## ADNEAL AND PERIUTERINE CONDITIONS

**Concerning Salpingography** (Ueber die Salpingographie) **HEINRICH MARTUS, Dtsch. med. Wschr., 947**  
7 657

The author discusses the relative merits of the injection of air to test tubal patency versus the use of an iodized oil, and the roentgenological demonstration of the hysterotubal tract. He calls attention to the fact that the patient presenting herself for the diagnosis of sterility is an otherwise normal person, and, therefore, must be treated in a manner which will not do her any manner of harm. He believes that, in general, the injection of air is a far more innocuous procedure than the injection of the contrast medium. He believes that the larger number of complications reported following the former procedure is due to the fact that it is so frequently carried out in the offices of other than competent technicians and that it is all too often viewed as a simple office procedure.

One case is cited in which there were adhesions evidently following a hysterosalpingogram, and that separation of the adhesions disclosed small yellow masses which he believed were remnants of the iodized oil. The use of urographic media in water solutions has not been successful in his hands because of the lack of viscosity and rapid emptying from the fallopian tubes. Furthermore he believes that the radiation incident to the filming of the area should not be considered too lightly and that this may well cause harm to the ovaries and to the maturing ovum.

The author also points out that either procedure must be preceded by a careful gynecological examination made both manually and by observation through a speculum. He believes that as a therapeutic procedure the injection of air is preferable, as the iodized oil may of itself set up an inflammatory process, although this will probably take place only in an already diseased tube. **WILLIAM C. BECK, M.D.**

**Studies of the Human Corpus Luteum.** **JOHN L. BREWER AND HAROLD O. JONES, Am. J. Obs., 943, 55 18.**

The purpose of this article is to present a histologic study of corpora lutea and endometrium in instances of functional uterine bleeding, and to discuss the relationships of these two tissues. Specimens are described and interpreted. The specimens in each instance were obtained by hysterectomy and oophorectomy or by resection of the corpus luteum. The operations were performed during the bleeding phase, since it is during this period that most accurate interpretations can be made.

The authors found that functional uterine bleeding may occur when a corpus luteum is present in the ovary. The endometrium in some instances may evidence irregular regression. The irregular regression is the result of prolonged life and function of the corpus luteum. The endometrial picture will vary depending upon the rate and extent of regression of the corpus luteum. The bleeding which occurs seems to be an exaggeration of the normal bleeding processes observed in cyclic menstruation.

The corpus luteum in other instances may be histologically and functionally normal. The endometrium, except in small regions, responds normally. It is from these small regions that bleeding occurs. The bleeding in these instances is independent of the corpus luteum and of the remainder of the endometrium. The bleeding is unlike the usual normal menstrual bleeding. It is localized bleeding from blood sinuses with scant loss of endometrial tissues. During this type of bleeding ovulation can occur, corpus luteum development can progress normally, and the endometrium not involved in the bleeding can develop normally. The phenomena that occur that produce the bleeding in such instances are not known. The explanation may reside in a local bleeding factor in the endometrium or in the local abnormality of response of the endometrium.

JOHN R. WOLFF, M.D.

#### EXTERNAL GENITALIA

**High Lymphadenectomy and Sympathectomy in Carcinoma of the Vulva** EDWIN M. ROBERTSON  
*Am. J. Obst.* 1948, 55, 79.

The successful treatment of carcinoma of the vulva differs in no way from that of carcinoma in other sites in that the primary lesion, the spreading growth and the metastases in lymph nodes must be completely destroyed or eradicated.

Because the malignant vulvar tumor is situated on a part of the body which has an enormously wide spread lymph drainage system, the exact limits of surgical excision required are difficult to estimate as are the sites and dosage of radiation. However it seems that the radiation therapy of vulva carcinoma and lymph node metastases in the groin for example, is more limited than surgical excision of the affected parts and therefore vulvectomy and lymphadenectomy are the more favored procedures.

The author reports a case of carcinoma of the vulva occurring in a woman 37 years of age for which wide vulvectomy, bilateral inguinal and pelvic lymphadenectomy, right lumbar lymphadenectomy and lumbar sympathectomy were performed. The procedures are described.

It was not without very careful consideration that the accepted limits of surgical treatment of vulvar carcinoma were exceeded in this case but the relative youth of the patient, the large size and prolonged history of the growth, confidence in the safety of modern surgical procedures to avoid shock and infection and a hopeful confidence perhaps quite mis-

placed in concomitant sympathectomy as a means of lessening the chance of development of thrombosis and embolism were strong impelling influences.

JOHN R. WOLFF, M.D.

#### MISCELLANEOUS

**The Detailed Anatomy of the Paraurethral Ducts in the Adult Human Female.** JOHN W. HUFFMAN  
*Am. J. Obst.* 1948, 55, 86.

Skene's presentation in 1880 established the clinical significance of the paraurethral ducts. However the extent and the detailed anatomy of these structures still remain a controversial matter and a review of the present day literature confirms Everett's statement that there is no unanimity of opinion on the subject of paraurethral and urethral glands. The purpose of this presentation is to describe the paraurethral ducts and glands of several adult human females in an effort to portray at least in part, the anatomy of the prostatic homologue in the female.

The material studied consisted of serial sections and wax model reconstructions of adult human female urethras. As a result of this study a concept of the anatomy and histology of the paraurethral ducts is presented. It would appear that these ducts are not constant in number or location, that they not only form extensive ramifications throughout the tissues about the distal urethra, but that they may also extend to within a short distance of the bladder and that the often numerous ducts terminate in tubular glands which are lined for the most part by columnar epithelium. This epithelium has some at least though limited secretory activity.

The role which the paraurethral ducts may play in the etiology of lesions of the urethra and anterior vaginal wall is discussed.

JOHN R. WOLFF, M.D.

**Tumorlike Scleroses in the Submucous Connective Tissues of the Urethra in Women following Castration of the Menopause** (Scléroses sous-urétrales pseudo-tumorales chez la femme castrée ou ménopausée) M. CHAMPEAU  
*Rev. chir., Par.*, 1948, 67, 59.

A 75 year old woman, of fastidious personal habits had been suffering for about a month from delay slender stream and terminal dribbling with urination. There was some frequency of urination especially at night. There had also been some bleeding from the urethra. A thickened, dense mass was found extending the length of the urethra between this structure and the anterior vaginal mucosa. The mass was molded to the curvature of the urethral lumen. There was some eversion of the meatal mucosa (bleeding). Following a preliminary cystostomy the supposed tumor was easily excised and found to be composed exclusively of dense connective tissue. Four years later the condition recurred minus the bleeding. The urinary troubles were not so bad as originally.

Three other identical conditions have since been encountered, one in a 52 year old female who had

undergone a hysterectomy 4 years previously another in a 61 year old woman in menopause for 10 years, and the third in a 46 year old woman who had undergone bilateral ovariectomy 4 years previously. In the last instance the condition was causing no symptoms.

In the 52 year old patient the mass was again easily excised and again it returned after 2 years, despite vigorous treatment with estrogens and progesterone including an implantation of 100 mgm. of folliculine.

In the 61 year old patient the sex hormones were again without effect and the mass was excised this time with difficulty which resulted in a small fistula that healed spontaneously after 3 weeks time. The patient did not return.

In the last patient the mass was not removed but later a hysterectomy was done and after that the urinary difficulties disappeared the tumor remaining unchanged.

The author believes this condition to be a hitherto undescribed manifestation of sex hormone deficiency and recommends prophylactic treatment with ovarian hormones in high dosage.

JOHN W. BREDMAN, M.D.

Care of Patients with Advanced Pelvic Cancer  
WILLIAM E. COSTLOW *Radiology* 94B, 50-3

The author presents some generalized recommendations concerning advanced pelvic carcinoma.

Primary carcinoma of the vagina is considered by him a radiological problem at any stage, and from

85 to 90 per cent of all grades of cervical carcinoma are also considered entirely radiological problems. From 10 to 15 per cent of the cases are in stage I, and thus, may be considered operative. It is the author's belief that the operable types of corpus carcinoma should be given radium preoperatively.

The author believes that pelvic carcinoma should be considered a major medical and surgical problem. Attempts should be made to eradicate infection before treatment is commenced. Douches, sulfonamide drugs, penicillin and transfusions should be resorted to. X-ray therapy often aids in removing infection. Proper care regarding filtration, careful packing of the bladder and rectum away from the applicator and the use of retention catheters and greatly in this type of cancer therapy.

The most common complications in this region of the abdomen are cystitis and proctitis. Vesico-vaginal fistula occurs occasionally. Ureteral obstruction, when present, is almost always due to neoplastic disease but sometimes it is due to scar tissue in the parametrium. When severe pain complicates the picture, such surgical procedures as posterior rhinotomy, anterolateral cordotomy and presacral nerve section are recommended.

The radiation therapist should follow his patient up in co-operation with a general physician. There is increasing need for physicians thoroughly trained in cancer therapy who will follow up the advanced as well as the early case and thus administer the aid and palliation the patient needs.

HENRY C. FALK, M.D.

# OBSTETRICS

## PREGNANCY AND ITS COMPLICATIONS

A Clinical and Histopathologic Study of Lesions of the Cervix Uteri during Pregnancy C. F. FLUHR  
MAMM *Am J Obst* 1948, 55 133.

An important feature of prenatal care is a careful inspection of the cervix uteri. This procedure often reveals pathologic lesions which exist with or without symptoms such as vaginal bleeding, and demand immediate attention. The object of this study is to present an analysis of the histopathologic findings in a series of 89 cases in which a gross abnormality was recognized and a biopsy of the cervix was obtained or a hysterectomy was performed. All stages of gestation are represented.

Gross and histopathologic examination revealed that mucous polyps of the cervix were found in 37 cases, erosion of the cervix in 32, carcinoma of the cervix in 10, condyloma acuminata in 5, endometrial polyps in 3 and leucoplakia in 2.

The generally accepted description of the cervix during gestation is that presented by Steve in 1927. The most prominent changes are to be found mainly in the connective tissue elements during the first 2½ months. There is a tremendous increase in the number of blood and lymphatic vessels which continues throughout the whole of pregnancy so that eventually the cervix becomes a soft boggy structure comparable to erectile tissue. There is an increased activity of the cervical glands which is progressive throughout pregnancy, but does not become marked until after the twelfth week. From then on the glands increase in number, invade the substance of the cervix, and project into the cervical canal.

The gross and microscopic appearance of cervical erosion is described and its etiology is discussed. The present concept, advanced by Meyer and others, that all erosions should be considered the result of infection is not supported by the author's histopathologic analysis which suggests that these lesions should be considered as adenomas of the cervix. Extensive cervicitis was present in only 9 instances.

Although the largest group of lesions in the series were mucous polyps, originating either from the external os or from the cervical canal, bleeding occurred in only 6 instances.

Hyperactivity of the basal cell layers of the squamous epithelium and epidermidization occurred both in so-called erosions and in some mucous polyps. These abnormal proliferations are especially prone to occur during pregnancy and consequently there is here a wide field for further investigation and observation in view of the search for methods dealing with the recognition of early carcinomatous changes.

The subject of cancer of the cervix uteri during pregnancy is far beyond the limits of this article but as a matter of record some details are given

of the 10 cases of carcinoma of the cervix uteri during pregnancy observed in the Department of Obstetrics and Gynecology at the Stanford Medical School San Francisco California JOHN R. WOLFE M.D.

## LABOR AND ITS COMPLICATIONS

The Expectant Management of Placenta Previa  
TIFFANY J. WILLIAMS. *Am J Obst.*, 1948 55 169.

The maternal mortality in placenta previa has been appreciably reduced in the past decade mainly by the replacement of blood loss by adequate transfusions of whole blood. On the other hand fetal mortality remains high in a great measure because of prematurity. In order to improve the fetal results it is necessary to carry these patients closer to term. Ample properly matched blood and caution in the use of vaginal manipulations may make it possible to continue the pregnancy until the child is larger and so increase the fetal salvage.

The author presents the results in 105 cases of placenta previa seen at the University of Virginia Hospital, Charlottesville, during the past 11 years. For 71 of these patients were treated in an expectant manner. Obviously there can be no expectant treatment once labor has begun. Likewise if the patient is at or near term there is no advantage in attempting to prolong the pregnancy.

Placenta previa requires hospitalization for diagnosis and treatment. In the event that the child seems too small to survive and if labor has not begun an expectant attitude may be adopted. A gentle examination and inspection of the vagina and cervix may be done to eliminate the possibility of some infrequent cause of bleeding such as ruptured varices or cervical tumors but the cervical canal should not be explored. These patients should be kept under observation as were 41 patients in the authors series for periods of time varying from 2 days to 3 months in an effort to obtain a child which will survive. Five of the babies (12%) borne by these 41 patients were lost, one of these was delivered at term by cesarean section and died neonatally of congenital malformation and 4 were born prematurely—one a stillborn and 3 dying neonatally. The fetal mortality in this group who were treated expectantly is considerably better than the fetal mortality of 28 per cent for the entire series.

The preferred methods of delivery were either cesarean section or induction of labor by rupture of the membranes according to the station of the presenting part, the degree of previa, and the condition of the cervix. The one maternal death is reviewed.

The author concludes that an attempt to carry patients with placenta previa to term seems to be reasonably safe and is worthy of trial although some of them will go into spontaneous labor prematurely while others will have such persistent or profuse

bleeding that one is reluctant to continue an expectant attitude.

JOHN R. WOLFE M.D.

**Functional Dystocia following Cesarean Section through a Transverse Incision of the Lower Segment** (*Distocia funzionale conseguente taglio cesareo con incisione trasversale del segmento inferiore*) GIOVANNI PAROLI *Riv ostet g* 947 244.

A surgical problem always interesting and always open to discussion is whether a longitudinal or a transverse incision through the lower uterine segment is preferable in performing a cesarean section.

The transverse incision with modifications is held to be anatomically correct by most authorities. In the lower uterine segment, the majority of the muscle fibers run in a horizontal plane as do most of the blood vessels. A curved incision with the convexity downward is supposed to cause destruction of fewer anatomical structures.

Most authorities agree that regardless of the operative method the immediate results (danger to mother and fetus) and the remote results (resistance of the uterine scar in subsequent pregnancies) are equally good whether the longitudinal or the transverse incision is used.

Few reports have been made on the effects of cesarean section by the two methods on the functional activity in subsequent pregnancies e.g. motor activity and other dynamic phenomena.

In this regard 2 cases of dynamic dystocia following cesarean section through a transverse incision are reported and discussed.

The first case reported by the author was that of a 33 year old woman who was operated on by cesarean section through a transverse incision to terminate her fourth pregnancy on account of placenta previa. She had formerly had three normal deliveries. The postoperative course of the cesarean section was complicated by suppuration of the operative wound. A year after the section the patient entered the hospital in labor with the fetus in a vertex presentation the head not descending although the uterine contractions were strong. After 8 hours of labor the cervical dilatation was 5 cm. and the cervix was flexible. In spite of the soft sensation the cervix was asymmetrically dilated. The posterior lip of the cervix was more dilated than the anterior lip and during strong and regular uterine contractions the posterior lip stretched while the anterior one appeared flaccid and inert. After another hour of good contractions with pain essentially limited to the suprapubic region the local situation remained the same notwithstanding the fact that the fetal membranes had already ruptured. A diagnosis was made of arrested descent of the head and faulty cervical dilatation due to functional motor dystocia of the uterus. Manual dilatation was carried out and a classical podalic version was done without anesthesia. With the hand in the uterus while turning the fetus, a rigid semilunar band was felt in the anterior uterine wall at the site of the scar of the former transverse

cesarean section. A living fetus, weighing 3,500 gm was delivered.

Three years later the patient returned to the hospital 9 months pregnant. Dilatation of the cervix was incomplete. Manual dilatation was easily carried out. The head of the fetus was engaged, forceps were applied and a living fetus weighing 2,900 gm. was successfully delivered. The puerperium was normal.

Dynamic dystocia thus occurred in 2 successive pregnancies in a multipara who had formerly had 3 normal pregnancies and a fourth pregnancy terminated by transverse cesarean section.

The second case, presented by the author was that of a woman of 33 years who had undergone a transverse cesarean section to terminate her first pregnancy on account of a prolapsed cord. The postoperative course was complicated by suppuration of the operative wound. She entered the hospital for the delivery of her second child, the latter being in the oblique position. About one hour after entry the fetal membranes ruptured spontaneously. The uterine contractions were regular with complaint of pain in the suprapubic region. After 7 hours the cervix was dilated to the breadth of two fingers. After 18 hours, notwithstanding strong uterine contractions the dilatation was only 5 cm. with the anterior lip inert. The cervix was dilated manually forceps were applied and delivery of a living fetus weighing 3,500 gm. was accomplished.

Outstanding features common to both of these cases were difficult and incomplete dilatation of the cervix in spite of apparently normal uterine contractions without signs of cervical spasm, difficult engagement of the fetal head with lack of progress of the presenting part, the presence of suprapubic pain during uterine contractions instead of pain usually referred to the lumbosacral region and that both patients had had a cesarean section through a transverse incision in the lower segment followed by postoperative suppuration of the operative wound and the formation of a bandlike scar in the lower part of the anterior wall of the uterus.

Defective repair of the anterior wall of the uterus is believed by the author to be responsible for the dystocia in deliveries subsequent to a former delivery by transverse cesarean section. He holds that the longitudinal nerve pathways are interrupted by the transverse incision, and, as a result, during labor the normal nerve impulses, which give rise to the intersegmental uterine contractions are unable to pass to the lower segments of the anterior uterine wall and the anterior cervical lip. The dilatation of the cervix is interfered with and the descent of the fetus is arrested on account of failure of contraction of the lower uterine segment.

The transverse scar per se does not necessarily play a part in the dystocia, for while the majority of the muscle fibers of the lower segment are in a circular plane, some are oblique and some are longitudinal. When the scar is denser than normal on account of postoperative suppuration of the opera-

tive wound it becomes the site of suprapubic pain during dystocia. Ordinarily the pain of childbirth is lumbosacral but that of the 2 cases reported was suprapubic. The author believes that the origin of infection of the operative wound of cesarean section is usually endouterine after faulty wound repair.

In conclusion, the author believes that the incision in cesarean section should be considered from a functional standpoint and not a purely anatomical one. Transverse incision should be reserved for those cases in which the longitudinal incision is definitely contraindicated (e. g., in the presence of midline tumors or abnormal bladder adhesions).

BLACKWELL MARKHAM, M.D.

## NEWBORN

Premature Births. LEWIS A. KOCH, C. A. WEYMULLER, and ELIZABETH JAMES *J Am M Ass* 1948 136 317

Prematurity is the leading cause of death in the newborn. In one-half of these newly born infants death occurs during the first 24 hours of life as the result of birth trauma and asphyxia during labor and delivery. The obstetrician's contribution to the reduction of this rate is twofold, namely attempted reduction of premature delivery and protection of the infant during labor and delivery.

A list of helpful suggestions are presented: (1) adequate supervision of the hygiene of pregnancy; (2) proper advice concerning diet, coitus, rest, and exercise; (3) immediate notification of the obstetrician whenever any untoward symptoms occur; (4) early discovery of syphilis and vigorous treatment for it throughout pregnancy; (5) prevention of congestive failure in cardiac disease through joint supervision by cardiologist and obstetrician; (6) determination of the size of the fetus by means of roentgenography and consultation with a competent obstetrician before interrupting pregnancy by artificial means; (7) elimination of morphine, scopolamine, barbiturates, and general anesthesia in all labors in which prematurity is involved; (8) administration of vitamin K to the mother before pregnancy is interrupted and to all premature infants immediately after birth; (9) preservation of the membranes as long as possible and episiotomy to protect the premature infant from the pressure effects of labor; (10) spontaneous delivery of the second twin and avoidance of version and extraction whenever possible; (11) postponement of the tying of the cord until it stops pulsating so that the child may receive as much blood from the placenta as possible; (12) reception of the newborn premature infant in a tub of warm water to prevent chilling while waiting for the cord to stop pulsating.

The authors discuss the pediatrician's role in reducing the mortality from prematurity. They outline their own technique and quote favorable clinical statistics to support their contentions. The delivery rooms are prepared for the reception of the premature infant, and a heated crib, facilities for the administration of oxygen, and a warm tub are available.

Their nursery unit admittedly not ideal is so planned that each unit is as small as possible, consisting of 7 term babies and 1 premature infant. The care of infants in this unit is conducted by one nurse who does not handle any other babies. The danger of contact infection from visitors to mother to baby has been reduced by requiring all visitors to wear masks and gowns and by the use of rope barriers which prevent contact with the bed or bed clothes.

The personnel must have throat cultures; the nurses are required to wear a mask and gown and physicians and cleaning women are required to wear a mask, gown, and sterile gloves. All equipment is sterilized before it is placed in the unit and each unit is self-sufficient. Infected infants are removed immediately and no new babies are placed in that unit until the remaining babies have been discharged and the room has been thoroughly decontaminated. The authors stress the maintenance of adequate records on the progress of infants and at present house officers are more closely supervised than had previously been the custom.

From 1924 until 1940, 1,125 premature infants were born in the Long Island College Hospital, New York, New York, with a mortality rate of 28.4 per cent. Since the institution of the previously mentioned measures from 1940 to 1945, 637 premature infants were born with a mortality rate of 16.3 per cent, an overall improvement of 30 per cent.

JAMES F. DONNELLY, M.D.

## MISCELLANEOUS

The Ectodermal Elements of the Situs Placentaris (Gli elementi ectodermici del "Situs Placentaris")  
LUIGI DE GIROGI *Arch ital gen* 1947 58 129

In the normal process of placentalation, elements defined as ectodermic in nature are found in the ambit of the decidua basalis and of the myometrial strata. It is the intention of the author to study this phenomenon and its quantitative variations during the gravid state, its genesis and disappearance, also the behavior of these elements in cases with retention of placental tissue after abortion and delivery. He is also interested in the influence which certain pathological uterine conditions (myomas of the corpus uteri, carcinomas of the cervix of the uterus, chronic metritis), certain diseases of the ovary (tumors, ovarian cysts), various maternal diseases (tuberculosis, osteomalacia, eclampsia), as well as placenta previa and ectopic pregnancy will have on such elements.

After an accurate and meticulous revision and discussion of the literature, the author proceeds to report his cases, 36 in all, representing various stages of pregnancy and the puerperium. There were 8 cases of ectopic pregnancy and 20 cases representing uterine scrapings from postpartum and postabortive retention. He presents his conclusions from histological study of the situs placentaris.

In the ambit of the situs placentaris is to be noted the prevalence of elements mononuclear, polygonal



or fusiform with granular protoplasm and a nucleus round or oval in shape also elements polynuclear and gigantic with a hyperchromatic nucleus and a granular homogeneous protoplasm, and elements both mononuclear and polynuclear and with a fibrillar protoplasm. These elements are distributed sparsely or in colonies and with a quantitative variation more accentuated in the fourth, fifth, eighth, and ninth months of pregnancy, they are not influenced by constitutional disorders or diseases of the uterus and adnexa and retrogress and disappear 2 weeks after delivery or after interruption of pregnancy. These elements are totally absent in tubal pregnancy. As collateral findings there are trophoblastic elements in the lumen of the vasa of the decidua and myometrium; these are more prevalent in cases of tubal pregnancy. In postabortive and postpartum retention of ovular residue, these elements persist longer than usual in the areas of decidua and myometrium where the retained tissue is attached.

A varied genesis of these elements is suggested by their characteristics of structure, quantitative proportions and topographic ubiquity. The mononuclear forms seem to originate from cytotrophoblastic elements although it has been suggested that such elements can originate also from the cells of Langhans, the polynuclear and mononuclear types with a fibrillary protoplasm must originate from muscular elements, while the polynuclear forms with a clear protoplasm and nuclei defective in chromatin must originate from decidua cells. The author concludes that the cellular elements characteristic of the situs placentaris, with a muscular decidua and connective tissue origin must be understood to be quantitatively and functionally related to the elements of ectodermic origin. Trophoblastic emboli are among the vascular changes found con-

stantly in the placental bed. In eclamptic patients, these are found in the vessels of the uterus as well as in other organs (lungs, liver). The characteristic cellular structure of these embolic formations gives them a trophoblastic origin.

In the ambit of the decidua basalis and myometrial strata of the situs placentaris, the elements of ectodermic origin constantly present are mostly gigantic polynuclears which differ quantitatively in each case according to the stage of pregnancy; also the elements of different origin (muscular, decidua, and connective tissue) which are present are in direct quantitative proportion to the ectodermic components. The definite absence, in the beginning of pregnancy, of germinative centers of such ectodermic elements gives them an autonomic property or character later in pregnancy which suggests a functional capacity. However, no hypothesis can be built on the functional activity of such elements. The gigantic mononuclear elements of the situs placentaris are an inherent characteristic of the process of placentation ectodermic in origin, and they vary quantitatively according to the activity of the chorionic ectoderm. This constant quantitative variation noted in the different forms of uterine pathology gives important information in the field of biopsy.

The terms "ectodermal invasion of the uterus" and "chorionic infiltration" must be reserved for special pathological entities. Ectodermal invasion must be reserved for those cases with a quantitative increase of ectodermal elements and a topographic anomalous presence of ectodermal elements in the myometrium. Chorionic infiltration suggests the penetration of chorionic cells within the venous sinuses of the myometrium as well as the lesions resulting from this endovascular anomalous invasion.

JOSEPH M. A. PAPP, M.D.

# GENITOURINARY SURGERY

## ADRENAL, KIDNEY AND URETER

The Possibility of Surgical Treatment of Anuria  
(Le possibilità della terapia chirurgica dell'anuria)  
G. PSACHAROPULO and C. ORECCHIA. *Boll. Mem.  
Soc. piemontese chir.*, 1947 17 247

Surgical treatment of anuria has at times been widely practiced, but in the last few years a reduction in the number of cases has been noticed in the literature.

With the increase in the incidence of anuria since the advent of widespread transfusion and sulfonamide therapy surgical treatment of this condition becomes a topic of renewed interest. After reviewing the results of operative treatment of anuria the author discusses the treatment given at the Surgical Clinic of Torino.

Surgical treatment of anuria consists of the following operations: decapsulation, nephrostomy, pyelotomy, ureterotomy, renal enervation and decortication of the renal artery. The following minor surgical procedures are also used: vesical distention, ureteral catheterization, anesthetic infiltration of the renal pedicle, anesthetic infiltration of the splanchnic nerves, spinal anesthesia and paravertebral nerve block.

Anuria, in a certain sense is always secretory for it always consists in an arrest of the secretory function.

The author follows this classification of anuria: (1) prerenal which is due to causes acting on the circulatory, humoral, or nervous mechanism independent of a primary change in the kidneys themselves; (2) renal due to inflammatory or degenerative processes which affect diffusely the renal parenchyma; (3) subrenal or postrenal caused by obstruction of the ureters or ureter in case of the existence of only one kidney; (4) arenal which occurs when one kidney is absent or severely damaged and the other is totally insufficient; and (5) reflex, which results when inhibitory nervous reflexes arise.

The mechanism by which the various surgical procedures act is discussed in detail.

Indications for surgical treatment of anuria are:

1. Prerenal anuria. The causes of this type of anuria which lie outside the urinary apparatus, include spasm, compression or obliteration of the renal vessels, anuria due to hypotension, hypertension with renal ptosis, and to changes in the blood, e.g. that due to asphyxia. Medical treatment of these conditions is usually very efficient. Minor surgical procedures, e.g. anesthetic infiltration of the renal pedicle or splanchnic nerves to relieve the spasm of the renal vessels, sometimes have to be employed.

2. Renal anuria. The transitory type of renal anuria which follows renal colic and operations, and lasts for from 12 to 24 hours without complications

is treated medically. In acute diffuse glomerular nephritis medical treatment is also efficacious. In the more serious cases decapsulation has been used with benefit. Treatment of chronic nephritis is medical, and that of renal damage resulting from poisoning by heavy metals in the majority of cases is also medical. In these cases decapsulation is of benefit only when done early before irreparable damage has been done to the renal parenchyma.

3. Postrenal anuria due to mechanical obstruction, either intrinsic or extrinsic, is best treated by the proper surgical treatment. In cases of intrinsic obstruction due to calculi, blood or tumors in the urinary system, relief is obtained by the surgical procedure indicated, e.g. ureteral catheterization, nephrostomy or pyelotomy. In cases due to extrinsic obstruction, e.g. pressure of tumors outside of the urinary system, surgical removal is the proper procedure.

4. Reflex anuria usually responds to minor surgical procedures.

Any surgical procedure which is indicated should be done early.

The routine treatment followed by the surgeons of the Surgical Clinic of Torino is given. During the first day or two of anuria, medical treatment is given. If the anuria persists for the second and third day, then minor surgical procedures are employed. If it persists for 4 days, or at most for 5 days, and the patient's general condition is satisfactory, then the proper major surgical procedure indicated in the case at hand is carried out.

In cases of acute nephropathy decapsulation gives good results in most cases. Nephrostomy in others. Surgical intervention is carried out on one side only. The temporary action of decapsulation and nephrostomy does not weaken their application because the treatment carries the patient over the acute episode and temporary relief favors permanent relief. The authors do not think surgery is of any use in cases in which the damage to the renal parenchyma is severe, which is indicated by complete anuria of several days' duration.

The authors have had no experience with the treatment of posttransfusion anuria but they give the results of French authors who have recorded many cases relieved by decapsulation and paravertebral anesthesia.

The authors have treated sulfonamide anuria successfully by medication in most cases. Rarely have they had to resort to minor surgical procedures such as infiltration of the renal pedicle.

Postrenal anuria is treated medically, only the exceptional case requiring relief by bilateral urethral catheterization or nephrostomy.

In reflex anuria, decapsulation has been done with good results in many cases. The majority of these cases can be treated successfully by medical treat-

ment or minor surgical procedures. Nephrostomy, when used, affords the advantage of exploration of the organ at the time of operation.

BLACKWELL MARKHAM, M.D.

**Hematuria from Aneurysm of an Arciform Artery of the Kidney** (*Ematuria da aneurisma di un'arteria arciforme del rene*) ANGELO MARINI. *Boll. Mem. Soc. piem. sc. let.* 1947 7 315

The cause of hematuria of renal origin can in most cases be determined very easily by modern diagnostic methods. The comparatively few remaining obscure cases of hematuria, so-called essential hematuria, can be treated successfully in 50 per cent of the cases (according to some authors) by simple renal enervation or decapsulation, exploratory nephrotomy and nephrectomy being required in the remaining cases.

A case of renal hematuria of obscure origin studied at the Institute of Urology and Pathological Anatomy at the University of Milan is presented and discussed.

A 61 year old male entered the hospital for the relief of renal colic. Eight days before he had wrenched his right flank while riding a bicycle. Later he developed pain in his right flank and passed bloody urine which contained clots over a period of 12 hours. Four days later the same events recurred. On entry physical examination was negative except for gross hematuria. Cystoscopy showed the right ureteral papilla to be plugged by a blood clot. On removal of a 2 cm. clot from the right ureter catheterization was performed and bloody urine was obtained from the right renal pelvis. Pyeloureterography was negative. Intravenous injections of vitamin C were given in an effort to arrest the hematuria, but they were ineffective. An exploratory operation was then resorted to and decapsulation of the right kidney was done. Postoperatively the hematuria returned and persisted. Twenty-eight days after the first operation, a second operation was performed at which time a nephrectomy was done. Histological examination of the kidney removed revealed that the hematuria was due to the presence of a small aneurysm of an arciform artery of the right kidney.

This case is reported as an example of the impossibility of making an accurate preoperative diagnosis in cases of essential hematuria. After the ordinary diagnostic procedures had failed to reveal the cause, even a nephrotomy failed to give additional information. Arteriography is perhaps the only method which would have thrown any light on the diagnosis and this is doubtful.

The author concludes that in cases of essential hematuria which are unaffected by all possible methods of medical treatment, surgical treatment should be employed promptly. Renal decapsulation should first be tried. Nephrotomy with removal of tissue for biopsy should be done in cases in which the exposed kidney suggests pathology of the renal parenchyma. When the hematuria persists in spite of these measures, radical nephrectomy should be

done to eliminate the danger of a neoplasm which cannot be diagnosed macroscopically.

BLACKWELL MARKHAM, M.D.

**Chronic Pyelonephritis.** J. H. CARVER. *Br. J. Urol.* 1947 9 35.

Chronic pyelonephritis is a serious disease, leading to the progressive destruction of the renal parenchyma. It is accompanied by hypertension in about 30 per cent of the cases. The disease may be unilateral or bilateral; the pelvis of the kidney is widened, the calices are clubbed, and the kidney may be reduced to half its normal size because of contraction. These changes are best seen in the retrograde pyelogram. The author reports 6 cases. He has usually found the organism to be the *Bacillus coli*, the *Staphylococcus*, or the *Streptococcus*. The symptoms are rather insidious and varied. There may be recurring attacks of pain in the loin, with frequency and burning. Repeated chills and fever are not uncommon. Most patients complain of lassitude, inertia, and the constant feeling of being below par.

The diagnosis may be difficult. Urinalysis usually shows low concentration, albumin, a few red blood cells, pus cells, and organisms on culture. Pyelography in the early stages of the disease may fail to show more than widening of one or two calices. Intravenous urography will likely demonstrate poor function. The blood urea is often elevated.

The author suggests that the term pyelitis be discarded as it does not reveal the true seriousness of the disease.

JOSEPH E. MAYER, M.D.

**Contribution to the Study of Primitive Papillary Tumors of the Renal Pelvis** (*Contributo allo studio dei tumori primitivi papillari del bacinetto renale*). FEDERICO TURONI. *Arch. ital. urol.* 1947 27 20.

A 39 year old fisherman upon returning from heavy labor noted that his urine was of a reddish-brown color and experienced vague pains in the region of the left flank, with "pollakiuria" and steady pain in the region of the bladder more intense at the end of micturition. At this time a physician diagnosed congestion of the neck of the bladder. During the following 3 months the pains occurred twice. Sixty days after the first attack the bleeding reappeared and was again associated with the symptoms described. This attack finally ended as urinary retention which was relieved by catheterization. Another attack of acute urinary retention led to hospitalization and the patient suffered another attack of hematuria while he was absolutely bedfast and without the slightest provocation.

Laboratory methods, particularly ascending pyelography suggested calculus however the absence of renal colic, febrile attacks, or pyuria, and the unprovoked hematuria favored the diagnosis of neoplasm. The kidney together with the ureter was removed. In the somewhat enlarged kidney pelvis was found a large cauliflower growth attached to the pelvic wall where it was reflected on a renal papilla. In addition there were a number of small papillomas.

tous excrescences scattered about at other points on the pelvic wall.

Histologic examination of these growths disclosed the characteristic stromal arborizations covered by the multiple layers of predominantly cylindrical epithelial cells resembling the normal mucosal lining of the renal pelvis. However as the basal zones of the tumor were approached the histologic picture indicated a lack of sharp delineation between the epithelial and the underlying stroma the pegs of epithelial proliferation in places penetrating for some distance into the underlying connective tissue which forms the supporting structure.

The author emphasizes in this report the superiority of clinical control over laboratory methods of diagnosis. He also insists on the necessity of ureteronephrectomy in these patients since in many there are secondary or accessory growths within the kidney substance and in the ureter.

JOHN W. BRENNAN, M D

**Ureteroduodenal Anastomosis.** JOSEPH G. FORTNER and JOSEPH H. KIEFER. *J Urol* Balt., 1948 50 31

Because the usual rectosigmoidal site for anastomosis of the ureters into the bowel is not entirely satisfactory the authors undertook an experimental study to clarify and re-examine the possibilities of ureteral implantation into the various portions of the small bowel.

The experiment was divided into 3 parts. In part 1 the ureters were transplanted into the rectosigmoid for the purpose of perfecting a technique and establishing controls which could be compared with the results of further investigation. In part 2 both ureters were transplanted into the duodenum at one operative procedure. In part 3 one ureter was transplanted into the duodenum at 1 operation followed by transplantation of the second ureter at a later date.

The dog was used as the experimental animal. The preoperative care consisted of nothing by mouth, with the exception of water for 36 hours prior to operation. At no time were the sulfonamides penicillin streptomycin or similar drugs used. A general diet was given to all dogs both preoperatively and postoperatively. Blood samples were drawn before the operation and every day or every other day thereafter, according to the condition of the dog. Nonprotein nitrogen and urea nitrogen determinations were made on these blood samples. Liver and kidney biopsies were taken at the time of operation. Upon death of the animal an autopsy was done and tissues taken for microscopic study. The anesthetic agents used were morphine sulfate and nembutal given intraperitoneally.

A modified Coffey 1 operation was used. With an anterior abdominal approach the ureter was mobilized from the urinary bladder to the kidney pelvis by opening the posterior parietal peritoneum. A longitudinal incision from 3 to 4 cm. long was made through the serosa and muscularis of the selected portion of the bowel. The distal end of the ureter was then implanted through an opening made through

the bowel mucosa at the distal end of this incision. The distal end of the ureter was transfixed by a suture through the wall of the bowel. The bowel wall was then sutured in two layers over the intramural ureter which completed a submucosal tunnel. The anterior abdominal incision was closed. Care was taken to keep the ureter straight and untwisted also to prevent compression in the submucosal tunnel. The blood supply to the ureter was carefully preserved.

Part 1: A control group of 7 dogs in which rectosigmoidal transplants were done. After completion of the study it was concluded that an anastomosis which would permit the operated animal to live a prolonged period of time had been made in all but 2 cases. Although some of the other animals showed evidence of hydronephrosis pyonephrosis or pyelonephritis, these continued clinically normal, and chemically demonstrated from slight to moderate elevation of their nonprotein nitrogen and urea nitrogen levels. Other anastomoses were entirely satisfactory.

Part 2: The second group (with bilateral implantation into the duodenum at 1 stage) included 14 dogs. Six of these animals died on the second and third postoperative days of factors which were not relevant to the experiment. The remaining 8 animals followed a singular similar course clinically chemically and pathologically. These animals lived from 5 to 12 days following the operative procedure. Clinically they differed only by being progressively less active than in their preoperative state. They did not eat or drink well postoperatively and demonstrated marked cachexia 2 or 3 days before death. Chemically there was an astounding rise in the nonprotein nitrogen and urea nitrogen on the first postoperative day. Following this there was a rapid rise in both values in an almost parallel fashion.

From this group it was concluded that bilateral transplantation of the ureter into the duodenum is surgically possible, but the animal's longevity is limited by factors to be discussed later.

Part 3: In this group (unilateral transplant into the duodenum at 1 stage followed by transplantation of the opposite ureter into the duodenum about 2 months later) 4 animals were used 2 of which lived 7 days. The remaining 2 were in such poor condition on the fifth postoperative day that they were sacrificed. The nonprotein nitrogen and urea nitrogen in the 2 surviving animals rose slightly, yet remained within normal limits during the first few days. Following the second stage procedure there was little or no difference from the animals in group 2 and the authors concluded that transplantation of the ureters into the duodenum in 2 stages does not give the animals a tolerance to a high nonprotein nitrogen and its consequent deleterious effects. The hydronephrosis encountered is evidence that the kidney continues to function more or less well in its new relationship.

The course of the animals with bilateral ureteroduodenostomy is such that two entirely different



service often 2 or 3 months after the cystostomy operation. In these cases the lumen of the urethra was not only obstructed but the proximal and distal urethral cul-de-sacs were often separated by several centimeters of dense cicatricial tissue often extending for considerable distances in various directions. In some instances previous reconstructive operations had been attempted and in others fistulous tracts purulent pockets and abscesses had to be given preliminary operative attention.

In many of these cases the roentgen films and even the case histories were lost so that in much the author has had to depend upon his memory however at least some detail is given in 26 cases. These included 9 cases observed before he developed his method of simultaneous ascending and retrograde urethrography and 17 observed after the method was developed. In the latter group there were 9 cases with extensive cicatricial destruction of the urethral lumen, 1 case with a moderate amount of destruction and 1 with a very small connective tissue block. Three cases were complicated by the presence of abscesses and in 3 cases the two ends of the urethra were displaced with reference to one another.

The operative procedure described is that used for the extensive injury with as much as 3 cm. of sclerotic tissue which blocks off the two ends of the urethra. When the patient is ready for operation that is, when any infectious processes are cleared up as well as possible the connective tissue is approached through the usual midline perineal incision the anobulbar ligament and the rectourethral muscle being cut to open up the prostatic space. An incision is made into the urethral lumen including that of the bulb and distal cul-de-sac and a catheter is retained in the closed distal sac of the urethra by an assistant acting as a guide. The retrograde catheter, also held firmly in the proximal sac, is palpated and the incision is carried backward being kept well forward, away from the rectum, so as to open up this part of the urethra also. The 2 ends of the urethra are then freshened and all the sclerotic connective tissue is cut away as thoroughly as possible even laterally as far as possible into healthy tissues. The in-lying rubber tube is then introduced in retrograde direction through the bladder and proximal urethral opening into the operative wound and thence through the distal portion of the urethra so as to protrude through both the cystostomy opening into the abdomen and through the external urethral meatus. Apparently no attempt is made to unite the two ends of the urethra and the membranous urethra is closed by any tissue which may be available around the rubber tube. In case of necessity even the anterior wall of the rectum may be used to fill out the defect. The incision in the bulbous portion of the urethra is then closed with great precision by means of small catgut sutures in several layers.

The postoperative care of the patient is at least as important as the operation itself. The in-lying rubber tube is retained in place for 25 days or longer, and it is kept covered with an antiseptic paste. If

signs of infection appear the tube (even though it become exposed in places) is not disturbed nor is any attempt made to cover it over with additional sutures as reconstruction of the urethral lumen is left to the natural proliferative processes of the tissues. If one or two sutures should show a little pus those sutures are removed but the others remain undisturbed. Constipation is induced for 7 or 8 days following the operation. However the dressings are changed daily even before the bowel is permitted to move. The in-lying tube is flushed out daily and kept sterile. In a few of the latest cases penicillin had become available and seemed to be of striking benefit.

All of the patients in this material were cured by this method. A few complained of some incontinence of urine and a few experienced periods of acute urinary retention however this difficulty could always be relieved by passing a sound and the condition was much relieved by diathermy treatments with a metal sound as electrode. The author believes that the retention resulted from urethral spasm.

JOHN W. BRENNAN, M.D.

## GENITAL ORGANS

A Study on the Subject of Occult Cancer of the Prostate (Investigación sobre el cáncer oculto de la próstata). JORGE E. LUPPI. *Rev. méd. Rosario* 1947 37 845

In the year from November 1943 to November 1944 the author procured 141 prostate glands from autopsies on males without discrimination as to age. This study was carried out at the Institute of Anatomy and Pathologic Physiology in Rosario.

These specimens were so prepared and sectioned as never to leave more than 4 mm. of thickness with out microscopic study. The stain used was hematoxylin-eosine. In this series cancer was found histologically in only 3 glands (2.1 per cent). However all of these cancers occurred in patients over 40 years of age of whom there were 111. Two of these cancers of the prostate were by no means occult but could have been diagnosed clinically in fact one of the patients died of metastases to the liver. Considering therefore that 1 case of occult cancer was found among 111 patients over 40 years of age the corrected figure of incidence would be 1.1 per cent, and for the entire number of 141 prostates from patients of all ages and fairly representative of the general population the incidence would be 0.7 per cent.

These figures are a far cry from the disquieting reports of high percentages of occult cancer of the prostate from other sources and the author, in an attempt to elucidate in every way possible the discrepancies thus introduced into the literature gives three possible sources of varying interpretations. The first is the case of the prostate which has already begun to develop the typical adenoma which in turn compresses the neighboring tissues collapses and distorts the glandular tubules and at times converts them into a mere trabecular strip of cells of irregular

size and shape. Another source of conflicting interpretation of the histologic picture might occur in the cases of senile prostates in which the normal processes may alter not only the form and disposition of the cellular elements but also the staining characteristics, and present on occasion a histologic picture very difficult to differentiate from that of incipient neoplasm. The final cause of confusion which the author has encountered may lie in the existence in the same prostatic matrix of 2 different types of glandular tubules. One type of tubules has cells of basophilic plasma and a compressed appearance with a tiny glandular lumen or no lumen at all, the cells themselves exhibiting meager amounts of plasma and a large deeply staining nucleus. The tubules are irregularly disposed and in general give the impression of a pseudoneoplastic process. The other type is composed of tubules whose cell-protoplasm may in contradistinction to the first type be designated acidophilic. These tubules form glandular mosaics lying closely side by side, almost without interstitial connective tissue. The lumina of these tubules are larger than those in the first type and contain rather small varying amounts of secretion. The cells composing these glandular structures are large clear and rather regularly arranged, with abundant protoplasm and lightly staining basally situated nuclei. These areas are interpreted by the author as possible beginnings of adenomatous prostatic hypertrophy with different types of histologic pictures because of the differing degrees of maturation of the component cells. All these findings he designates as pseudoneoplastic histologic manifestations.

JOHN W. BRECKMAN, M.D.

**The Medico-surgical Treatment of Cancer of the Prostate.** Subcapsular Orchiectomy and Hormone Therapy (Sur le traitement médico-chirurgical d' cancer de la prostate. Orchiectomie sous-capulaire et hormonothérapie). AUGUSTE CASUTO. *J. urol. méd.*, Par. 946-47 53 433.

This eminent urologist from Rome, Italy begins his address by expressing his appreciation of the courtesy shown him by the allied army of occupation and especially by Lieutenant Colonel Bissolero, chief of the sanitary service of the Army of the United States in Rome in providing him with medical literature and with such quantities of diethylstilbestrol gratis as he has needed for his work.

Since the opinions of writers do not agree as to the preferred treatment of cancer of the prostate the author feels no hesitancy in stating his own opinion although he has not been using his methods for a 5 year period as yet. He prefers immediate castration by subcapsular curettement of the glandular tissues of the testicle as proposed by Riba in 1912. Medical treatment with diethylstilbestrol is then initiated and continued for long periods of time. The usual dose of this preparation is 5 mgm. per day orally however the dosage is increased or diminished as indicated for the individual case. Some patients have tolerated as much as 1,000 mgm. of

diethylstilbestrol daily. When the castration has preceded the medical treatment no effects are noted on the breasts or general condition. If the patient proves to be intolerant to the diethylstilbestrol the dosage may be lowered or another preparation such as dienestrol may be substituted.

Of course if the patient refuses the operation, medical treatment is all that remains however in these cases the effects are pretty much the same although not so soon attained and not so pronounced. The most striking effects aside from the prolongation of life is the relief from incontinence and retention, and from pain. The tumor becomes softer and loses its rough nodular feel and even seems to decrease in size however the author has never seen the tumor disappear entirely. The pains ascribable to the metastases appear also to be relieved.

This is the first report of a chemical preparation which exerts an effect on cancer and this fact alone should spur research in this field.

JOHN W. BRECKMAN, M.D.

**Aseptic Prostatectomy** FRANCIS E. STOCK. *Br. J. Urol.* 947 9 306.

The method of prostatectomy originated by Wilson Hey is discussed and 24 cases in which this technique was used are reported. The author stresses that the diagnosis must be a clinical one, and that the patients must not be subjected to cystoscopy or catheterization before operation. If the patient is seen in a state of acute retention, the operation is performed as an emergency. The technique is described in detail.

After the bladder has been opened and emptied suprapubically a catheter is passed in retrograde fashion. The ureters are identified and a mark made with the diathermy knife  $\frac{1}{4}$  inch in front of each. From these marks a diathermy incision through the mucosa is made around the periphery of the upper surface of the prostate. Enucleation of the adenoma is then done, bleeding points being grasped and fulgurated as they are encountered. A V-shaped piece of the trigone is then removed, the apex of the V being posterior. A urethral catheter is then placed by "railroading" it through in a retrograde manner and fixed in the bladder by a Harris stitch. The bladder is closed in two layers, and tested for water tight integrity. A drain is left in the space of Retzius.

The catheter was removed on the third or fourth postoperative day and the drain from the space of Retzius on the second. Early ambulation as routine, as was chemotherapy.

The author's conclusions were favorable. There was no mortality. JOSEPH E. MAYER, M.D.

**Retropubic Extravesical Prostatectomy of Millin** (Die retropubische extravesikale Prostataktomie nach Millin) W. BRUNNEN, *Helvet. chir. acts* 1947 14 320.

The author reports on 50 cases of prostatectomy by Millin's method. His series of cases is classified

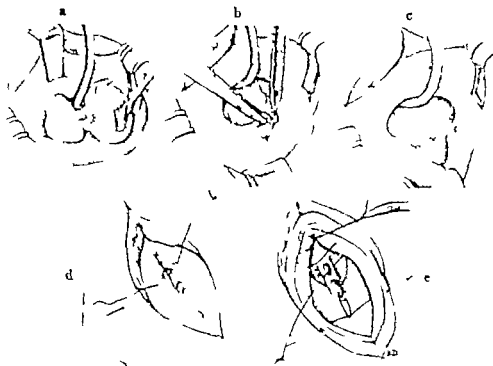


Fig 1 (Stock) a, Lateral lobes delivered into bladder. The floor of the urethra is divided with a diathermy cut at about the point where it dips out of sight. b, Excision of trigone with diathermy. c, Appearance of prostatic cavity after trigonectomy and incision of interureteric bar. d, Fixation of urethral tube and insertion of continuous catgut suture avoiding mucous membrane. e, Interrupted nylon sutures in one or two layers.

as follows: adenomatous prostatic hypertrophy (soft form) 28, fibrous solid form of prostatic hypertrophy, 9, prostatic hypertrophy with chronic interstitial inflammation 7, sphincter sclerosing or prostatic atrophy 3, and carcinomatous degeneration in prostatic hypertrophy 4. Millin's operation is described and the postoperative care is outlined. The postoperative course is particularly favorable, morphine seldom being required. Operative shock is slight and approximates that of perineal prostatectomy. The prevesical drain is removed about the third or fourth day and the catheter the sixth day.

Total urinary incontinence did not occur while relative incontinence with coughing and straining occurred once in a few weeks and twice in a few months. Urinary retention immediately or soon after operation occurred in 6 patients of whom 3 were among the first patients operated upon. As a rule in 1 to 3 days the urine was no longer bloody and postoperative bleeding in general was slight. Late bleeding occurred in 4 cases but was never serious. A slight wound infection without urinary fistula occurred in 2 cases and healed spontaneously. A transient urinary fistula was observed in 3 patients. Persistent urinary fistula was observed twice and was the most serious wound complication noted. Other complications were pyelitis 2 cases, pulmonary infarct, 1 case, and bronchopneumonia, 1 case.

There were only 2 deaths in the series in which the prostatectomy could be considered contributory, one occurring 5 weeks postoperatively from acute hem-

orrhage from a duodenal ulcer and the other after 7 weeks from liver insufficiency.

Sexual potency is not impaired as frequently following Millin's operation as after perineal prostatectomy. Millin's operation has 2 disadvantages, namely the danger of urinary fistula and of infection of the space of Retzius. These can be minimized by avoiding injury to the capsule with the diathermy needle.

JOHN L. LINDQUIST, M.D.

#### Oxidized Cellulose in Suprapubic Prostatectomy

GEORGE D. STUMP and ROBERT C. THUMANN, JR.  
*J. Urol.* Balt. 1948, 59, 102

Primary closure of the suprapubic wound following prostatectomy is not new, but it has never become a widespread or common procedure because of the frequent occurrence of postoperative hemorrhage.

By using the Foley bag catheter and oxidized cellulose, the authors wish to present a method of primary closure which is relatively simple and gives minimal postoperative bleeding. Hospital days are reduced as compared with other forms of suprapubic approaches; there is no urine spilling over the abdomen and the postoperative course by comparison is much more comfortable. The procedure follows:

1. The bladder incision is kept high in the dome with little prevesical and perivesical dissection.

2. After the prostate is enucleated, immediate hemorrhage is controlled by a hot pack held in the fossa for 5 minutes.

3. A 30 c.c. Foley bag is adequate for most cases.



4. Oxidized cellulose is placed smoothly around the Foley bulb.

5. The bag and gauze should be large enough to fold the vesical neck into the prostatic fossa.

6. There may be some bleeding along the course of the urethra, but this does not interfere with the function of the catheter and is not cause for alarm.

7. The bladder is closed completely in 3 layers.

8. Oxidized gauze begins to wash out on the operating room table and is usually all out within 72 hours.

9. The catheter is removed by the sixth or seventh postoperative day and the patient allowed to void.

10. If the catheter does not drain well, it may be replaced at any time.

A total of 15 primary closures with oxidized cellulose have been performed at Harper Hospital, Detroit. Eleven cases of uncomplicated benign hyperplasia of the prostate are presented. The other 4 cases presented complicating features which will be mentioned later.

In all of the 15 cases immediate postoperative bleeding was a minimum. In 1 of the 11 cases, the suprapubic wound reopened and urine drained out upon removal of the catheter. This was attributed to a low incision in the bladder at the operation which tore into the vesical neck during the enucleation and made closure of the bladder difficult and inadequate for primary closure.

In 1 other case in which removal of the catheter was anticipated on the ninth postoperative day, the patient bled from the prostatic bed the night previous which necessitated delay in removal of the catheter.

In all but 2 cases, the urethral catheter was removed between the sixth and eighth days. The patients voided freely and maintained a solid suprapubic wound.

In 1 patient cystoscopy was done on the tenth postoperative day. No oxidized cellulose was present and epithelization had begun.

In 1 of the 4 cases not included in the series the pathological report was adenocarcinoma, although the preoperative diagnosis was benign hyperplasia of the prostate. In view of this, an indwelling catheter was left in 13 days as delayed healing was anticipated. The patient went home voiding freely with a solid suprapubic wound on the fifteenth postoperative day.

Another patient with a complicating urethrocutaneous fistula at the penoscrotal junction maintained an indwelling catheter for 10 days and went home voiding freely with a solid fistulous tract and suprapubic wound on the fourteenth day. The pathological report was leiomyofibroma of the prostate.

The third case is mentioned to show the complications which follow the placing of the Foley bulb in the prostatic fossa itself. The postoperative course was beset with severe bladder spasm and incontinence because a discouraging feature after removal of the catheter on the eighth day. Damage to the external sphincter had occurred from the inflated and tightly drawn Foley bulb. However the supra-

pubic wound remained closed in spite of the complications. Care must be taken in the proper placement of the Foley bulb.

The last case was that of a 74 year old man, which was complicated by severe atherosclerotic damage to the myocardium and auricular fibrillation. By the time of surgery the cardiac condition had been controlled with digitalis. Postoperatively the patient had clouding of consciousness for 12 days. The catheter was removed on the eighth day but because of the mental state, involuntary micturition, and persistent urine it was re-inserted until the sixteenth day after which the patient voided freely and maintained a solid suprapubic wound. Because of the cardiac and general status the convalescence was prolonged, the patient leaving the hospital on the thirty-fourth postoperative day. JOHN A. LOHR M.D.

**Spontaneous Gangrene of the Scrotum.** L. T. BARCLAY *Plast. Reconstr. Surg.* 94, 3: 56.

Spontaneous gangrene of the scrotum first reported by Fournier in 1884 presents the following salient features:

1. Sudden onset in an otherwise healthy male.
2. Rapid progression of the gangrene.
3. Total absence of the normal causes of gangrene.

Beside these three clinical features the majority of cases present other common factors, as follows:

1. Extensive and relatively constant areas of gangrene. The testes, spermatic cord, and inguinal regions are rarely affected. Involvement of the penis, especially in the region of the scrotopenile fold, is not common.

2. A tendency for spontaneous repair to occur. Manson believes that in most cases there are three triangular flaps of skin left at the margins of and projecting into the area of slough. Two of the flaps are based laterally one based posteriorly. Between these flaps lie both testicles. These flaps serve as centers from which epithelization begins. The repair appears rather to be due to contraction of new scar tissue which draws the remaining scrotum over the testes, than to the epithelium growing over the granulations from the periphery.

The etiology remains obscure, but two theories have been advanced to explain the onset of this condition. A fulminating erysipelas is the cause favored by the French authors, but this theory does not explain either those cases in which the infection is not due to the hemolytic streptococcus or those cases that arise spontaneously in otherwise normal males. A second theory suggests that the disease is a gas gangrene due to either the *Bacillus welchii* or other anaerobes.

Manson offers an alternative explanation. He believes that the condition is a vascular disaster of infective origin, analogous to cavernous sinus thrombosis. The infection does not have any specificity other than the presence of a pathogenic organism which causes rapid thrombosis in the area supplied by these vessels. The blood supply to this region accounts for the constant area of slough, and also for

the presence of the three flaps. This area is supplied by the external branch of the femoral artery and the superficial perineal arteries. The limitation of slough on the under surface of the penis is due to the fact that the dorsal vessels remain intact having no connection with the veins of the mediastinum below the urogenital diaphragm. The high mortality and the profound illness of these patients suggests more than localized gangrene of the scrotum due to vascular occlusion. It would seem that a combination of factors are responsible for the onset of this condition.

The treatment of choice is the radical removal of the necrotic area for this procedure provides free drainage and helps to speed recovery. Surgical repair by skin graft is considered unnecessary.

The author reported a case in which a patient 44 years of age had been entirely well prior to the spontaneous onset of his illness. He was hospitalized in an acutely ill condition. The admission diagnosis was spontaneous gangrene of the scrotum with associated deep thrombophlebitis of the left leg and infarction of the lower lobe of the right lung. The treatment consisted of tulle gras dressings to the scrotum. Eusol in gauze dressings were renewed twice a day. Chemotherapy consisted of penicillin (14,000 units every 3 hours) and adequate doses of sulfadiazine by mouth. Dicumarol (200 mgm.) was given on admission and 100 mgm. were given daily under control by daily prothrombin estimations. A full diet and 3,000 c.c. of fluid were given each day. Healing was rapid under this regime, and on the twenty-eighth day the patient was discharged in good condition.

CONRAD A. KUZIN, M.D.

### MISCELLANEOUS

Reiter's Syndrome. ALBERT A. CREECH and FRANK S. BEAZLEY, JR. *J. Urol. Balt.*, 1948, 59: 234.

In 1916 Hand Reiter, while perhaps not the first to see, was first to describe a clinical syndrome characterized by urethritis, conjunctivitis and arthritis which was nongonorrheal in nature.

Since Reiter's original description 152 cases have been reported in the literature to our knowledge.

All the cases reported in the literature have occurred in young males (the youngest 16 the oldest 42), with the exception of 1 case reported by Lever and Crawford which occurred in a female but about which there is doubt as to its proper classification. Recurrences are seen in about 25 per cent of all cases at intervals of months to years. Multiple recurrences are not uncommon.

The disease process is acute in onset with its manifestations appearing promptly and tending to increase in severity in the first 4 weeks. It is usually ushered in with urethritis or arthritis followed by conjunctivitis, but the manifestations often supercede or superimpose one another and have no constant relationship. In some cases transient diarrhea, cutaneous lesions or ocular symptoms have ushered in the disease. In over 95 per cent of the cases no venereal history or history of sexual exposure within

a significant interval has been obtained. The urethritis and conjunctivitis have been purulent and tend to clear up in a relatively short period of time. The arthritis which is the most persistent and disabling manifestation is usually polyarticular but cases of monoarticular involvement have been reported. In addition to the cardinal triad and complications described by Reiter many other features have been described including interitis, keratitis with peripheral ulceration, balanitis circinata, prostatitis, prostatic abscesses, vesiculitis, hemorrhagic cystitis, dilation of the ureters and renal pelvis, pyelonephritis, joint effusions, and purpuric and vesicular cutaneous lesions.

The clinical course of the disease is protracted but self limited attacks varying in severity and lasting from 1 to 5 months with gradual complete recovery, leaving few or no residual symptoms. No form of specific therapy including arsenicals, urotropin, local antiseptics, sulfonamides, penicillin or gold salts has appreciably affected the course of the attacks. Beigebock used arthigen, a vaccine producing a foreign protein reaction in many of his 10 cases with good results. Others have reported favorable responses to fever therapy.

At the present time complete bed rest with symptomatic and supportive therapy is our best treatment.

The laboratory data are not diagnostic. There is usually a moderate leucocytosis of from 10,000 to 20,000, the sedimentation rate is rapid during the active phase returning to normal with recovery. A moderate anemia is usually present, the urine contains pus, the prostatic secretion often contains pus and the synovial fluid is purulent, but sterile.

The most consistent x-ray findings have been ill defined osteoporosis with occasional evidence of periosteal proliferation and narrowing of the joint space but this has not been constant.

Various etiologic agents have been suggested as the cause of the disease, including a spirochete, a staphylococcus, an enterotoxin, a filtrable virus and L-pleuropneumonia-like organisms. However smears and cultures of material from the urethra, conjunctiva, prostate, joints and cutaneous lesions have failed to demonstrate the gonococcus or other specific etiologic agent. Also blood and urine cultures, scrapings of the urethra and conjunctiva for inclusion bodies, darkfield studies of penile and mucocutaneous lesions, serologic tests, gonococcal complement fixation tests, agglutinations, animal inoculation, stool examinations and cultures, cold agglutination and fragility tests and Frei-Ducrey tuberculin and allergic skin tests have failed to substantiate or demonstrate a specific type of etiologic agent.

To our knowledge there has been no mention in the literature as to the possible role of foci of infection in Reiter's syndrome. We believe that the presentation of our 2 cases is of value from this standpoint in view of the events following the removal of a focus of infection in each case.

A 37 year old Jewish merchant was first seen with a history of urinary frequency burning on voiding, and a urethral discharge of 1 week's duration. He also complained of pain in the left shoulder which had been present for the same length of time, but had noted no swelling or limitation of motion. No other physical findings were abnormal except for a purulent urethral discharge and a soft, slightly tender and enlarged prostate. A smear of the urethral discharge showed numerous pus cells. The patient returned again 10 days later by which time mild bilateral conjunctivitis had developed in addition to his other symptoms which had not improved in the interval.

Laboratory examination revealed a trace of albumin and a few leucocytes in the urine. Other laboratory examinations were essentially negative.

While his symptoms were distressing the disease process itself was relatively mild. During his hospital stay the temperature did not go above 99.6°F. Codeine and aspirin sufficed to control the pain. He was given a total of 450,000 units of penicillin and was discharged in a much improved condition with only a slight urethral discharge after a 4 day hospital stay.

Two days after discharge, pain developed in the left knee and the pain recurred in his left shoulder. These pains were especially severe at night and kept him from sleeping. His urethral discharge also persisted although not so profuse as previously. Four days later he had a tooth extracted because of an apical abscess. The following day, the left knee became more painful and swollen and he was unable to bear weight upon it and at the same time he developed a moderately severe conjunctivitis. His symptoms became more severe in the following 3 days and he had a chill on October 5, 1945 following which he was readmitted to the hospital.

He was again placed on penicillin (50,000 units q. 3 hrs. for 33 doses) given codeine and aspirin for pain and moist heat was applied to the knee. The conjunctivitis subsided without therapy and gradually the swelling of the knee disappeared without aspiration.

He has remained asymptomatic up until the present (15 months later).

An 18 year old single white male blacksmith from a rural community entered the hospital with a history of having been well until a weeks before entry when he suddenly began passing blood in his urine and began experiencing chilly sensations and fever. He had urinary frequency every hour and burning on voiding. Shortly after the onset of the urinary symptoms pain developed in the right ankle joint. One week after the onset he noted that he was passing pus from his urethra. The right ankle was now swollen and more painful. At the same time he noticed a redness of both eyes and stated that the lids were swollen and stuck together in the mornings and that there was a whitish discharge from his eyes.

Repeated examinations revealed the urine to be alkaline with a specific gravity of from 1.005 to 1.015, a faint trace of albumin, innumerable leucocytes, and a moderate number of erythrocytes. No casts were found in any examination. Urine cultures were sterile, and smears were negative for any organism. Other laboratory data were essentially negative.

On cystoscopy the bladder urine was found to be grossly hemorrhagic and purulent. The bladder mucosa was intensely inflamed throughout but no active bleeding point was found. The ureteral orifices were normally located and of normal appearance.

While hospitalized, the patient was given adequate doses of sulfadiazine and penicillin without apparent benefit. Sodium salicylate did not relieve the joint symptoms. Sedatives and narcotics controlled the pain. Diathermy helped relieve the joint pain.

Following discharge from the hospital, the patient promptly had severe burning and pain on urination and had a recurrence of the swelling of his right ankle, which led to his second hospital admission.

In an effort to discover the etiology of this patient's disease, the question of a focus of infection was considered. It was believed that the patient had septic tonsils and their removal was advised. This was carried out, following which the patient had marked bilateral conjunctivitis, the dysuria became more marked, urethral discharge more profuse, and the right ankle more swollen, red, hot and tender. The symptoms gradually improved over a period of 3 weeks.

JOHN A. LOFF M.D.

# SURGERY OF THE BONES, JOINTS, MUSCLES, TENDONS

## CONDITIONS OF THE BONES, JOINTS, MUSCLES TENDONS ETC.

**Calcium, Phosphorus, and Phosphatase as Aids in the Diagnosis of Bone Lesions.** EDMUND B FLINK. *Radiology* 1948 50 71

Bone disease may in most instances be recognized by roentgen and clinical examinations. In certain cases correlation of all available data, including laboratory criteria, is necessary for a correct diagnosis. A review of calcium, phosphorus and phosphatase determinations and other procedures as they relate to the diagnosis of diseases of bone is presented.

The serum calcium is composed of two fractions the diffusible calcium and the nondiffusible calcium the latter constituting about 45 per cent of the total is bound to protein. When there is no renal insufficiency or hyperglobulinemia 1 gm. of protein binds approximately 0.75 mgm of calcium. Failure to recognize the protein effect may obscure actual hypercalcemia in hyperparathyroidism, or may lead to the false assumption of hypocalcemia.

The phosphatase activity of the serum is an important index of the osteoblastic activity in bone. Clinically two phosphatases are important the alkaline at a pH between 8.6 and 9.3 and the acid at a pH of 5.0. Hemolysis-free serum should be used for the determinations because of an erythrocyte phosphatase. Because of the large number of conditions in which the serum alkaline phosphatase is elevated the finding must be correlated with other observations. The significance of acid phosphatase is very special and relates only to carcinomatous metastases from the prostate.

Calcium excretion in the urine and feces may lead one to the proper diagnosis. Normally about two-thirds of the calcium is excreted in the feces and one-third in the urine. This ratio changes most markedly in diseases of the parathyroid gland. In hyperparathyroidism, the urine calcium is increased, in hypocalcemic states most of the calcium is excreted in the feces.

Hyperparathyroidism is a disease which may be primary in the glands themselves or secondary to renal changes. Care must be taken in the primary type to discern whether there is a functioning adenoma or general hyperplasia of the glands. Treatment of the primary type is surgical removal of the adenoma or subtotal resection of the hyperplastic glands. Careful investigation of patients with renal calculi and with mild polyuria and polydipsia should be made. An increase in urine calcium and serum studies may reveal a previously undiagnosed case of hyperparathyroidism.

The probability of the development of tetany after removal of a parathyroid adenoma or hyperplastic glands is much greater in patients with high values

for serum alkaline phosphatase than in those with normal levels.

Osteomalacia in this country has been chiefly associated with chronic mild steatorrhea. Investigation of tetany may lead to the diagnosis (confirmed by hypocalcemia and a decrease in urine calcium).

Paget's disease may be associated with acute atrophy of bone with the findings of hypercalcemia, polydipsia, polyuria and renal disturbances. These usually occur during immobilization for treatment of fractures in cases of Paget's disease. Under ordinary circumstances the calcium and phosphorus are normal. The phosphatase may be normal or elevated and depends on the extent of the bone involvement.

In multiple myeloma the serum calcium is often increased but the phosphorus and phosphatase are usually normal. Hyperglobulinemia occurs frequent

TABLE I—DIFFERENTIAL DIAGNOSTIC FEATURES OF DISEASES WITH DISTURBED CALCIUM AND PHOSPHORUS METABOLISM

Condition	Serum			Urine		Feces
	Ca	P	Phosphatase (Alkaline)	Ca	P	Ca
Hyperparathyroidism	I	D	N to I	I	I	N
Hyperthyroidism	N	N	N to I	I	I	I
Paget's disease	N	N	I	N to I	N	
Multiple myeloma	N to I	N	N	N to I	N to I	
Rickets	N	D to N	I	D	D	
Osteomalacia	D to N	D	I	D	D	D
Idiopathic steatorrhea	D to N	D to N	N to I	D	D	I
Renal tick	D to N	I	I	D	D	
Osteogenic sarcoma	N	N	N to I	N	N	
Metastatic carcinoma	N to I	N	N to I	I	I	
Prostatic carcinoma	N to I	N	I			
Neurofibromatosis	N to I	D to N	N to I			
Uremia	D	I	N	D	D	
Regeneration jaundice			I			
Hyperproteinemia	I	N				
Hypoproteinemia	D	N				
Acidosis	N	N				
Alkalosis	N	N		N	N	
Hyperparathyroidism	D	I	N	D	D	N
High vitamin D therapy	I	I	N	I	I	

N Normal. D Decreased. I Increased

ly as does the finding of Bence Jones protein in the urine. There is usually an increased excretion of calcium in the urine. Bone marrow study is confirmatory.

Osteoporosis associated with hyperthyroidism and the menopause is also discussed. A negative calcium balance may persist until the condition is stabilized. Renal osteodystrophy is discussed.

The differential diagnosis of bone diseases is schematically represented in Table I.

Further discussion of the differential diagnosis and a large bibliography is included in the article.

KENETH H. SPONKEL, M.D.

Central Bone Abscesses (Les abcès centraux des os)  
L. TAVERNIER. *Lyon chir* 947 4 64

Of the 22 cases here reported with brief case histories, 11 followed osteomyelitis, 5 an old infected fracture and 1 a polyarticular infectious pseudorheumatism. Of the remaining 5 bone abscesses, which were primary in the sense that their cause was not determined, it is quite probable that the search for the etiologic factor may have been insufficient. Therefore a special group of cases of the so-called Brodie abscess has not been made. In fact, these abscesses are not always chronic in their course and often tend to pass over into other forms of bone infection. Nevertheless, the primary abscess shows a number of peculiarities which set it off from the other forms. Its onset is more active and its course is not so prolonged (4 to 6 months from the first attacks of pain until the period of recognition). Its attacks of pain are not so violent and its roentgenographic appearance differs from that of the secondary abscess. This abscess destroys the entire thickness of the bone with the exception of the cortex which is itself often bulged out into a fusiform swelling resembling that of a cyst or benign tumor. However, the primary bone abscess should be easily distinguished since it is much more painful and is apt to be accompanied by fever and edema. The spina ventosa has a much less acute course. It may be more difficult to distinguish this abscess from a juxtaepiphyseal tuberculous osteitis for the distinction may finally rest upon the examination of the contents of the abscess itself.

The cases of secondary abscess may be divided into those which have developed a fistula, those which have not, those with an articular form which manifests itself as recurrent attacks of chronic arthritis until the condition is cured by the finding and removal of the original abscess in the adjacent bone and finally the abscesses which are secondary to an osteomyelitis healed by penicillin. Six of these 22 abscesses were accompanied by fistula formation all were recurrent, the periods when they were open giving complete relief to symptoms as a rule. In several instances there were present typical findings of abscess in the bone with typical relief of pain from drainage through the fistula yet upon operation the fistula was found to come from a secondary subperiosteal abscess while the original abscess with-

in the bone did not connect with it. The author especially emphasizes this finding as a possible explanation of some of the diagnostic errors which have occurred in the past. It may explain how one of the patients in this series could have been operated upon 14 times without discovery of the introsseous abscess. Another condition presenting extreme diagnostic difficulty is the postosteomyelitic painful hyperostosis when the roentgenogram does not show the typical shadow defect of the abscess because of the presence of marked eburnation and thickening of the bony cortex, the differentiation between this condition and painful hyperostosis or so-called hyperostosis with neuralgia, postosteomyelitic osteitis may in the absence of operation be simply impossible. In one instance in this material the roentgen technique did not demonstrate an abscess and no abscess was found by extensive trepanation of the bone and careful search yet the pains were not relieved by the operation and 8 days later the patient was reoperated upon, the abscess was located, and evacuation produced immediate relief.

Of course, when in the presence of a fistula the clinical or roentgenographic findings demonstrate the presence of an abscess the treatment is simple, it consists of trepanation of the bone, curettement of the contents of the abscess cavity and reduction of the edges produced by the trepanation to flat sloping surfaces so as to leave a residual shallow depression in the bone which can easily fill in with scar tissue or regenerated bone. In this process much time has been saved by the use of penicillin even in those cases in which the original abscess followed the failure of complete healing of an acute osteomyelitis in spite of the penicillin the drug seems to be just as potent in hastening the healing process following opening of the abscess and it is hoped that the drug will continue to prove capable of shortening the period of convalescence and healing of the bone following evacuation of these abscesses.

JOHN W. BROWN, M.D.

Malignant Degeneration of the Osteogenic Exostoses (Dégénérescence maligne des exostoses ostéogéniques) M. GUILLONNET, M. GARNIER, DUBOIS, PERRET and A. MAKLOUT. *Lyon chir* 947 4 70.

The authors present the case of a 37 year old woman who had suffered from congenital osteogenic disease since earliest childhood (18 months). She was covered with exostoses and these were especially large in the popliteal spaces and on the thorax. One of the masses (in the left groin) had begun to grow rapidly the lower extremity on that side measured 6 to 7 cm. more than that on the other side. This limb was cyanotic, edematous and exhibited marked collateral circulatory development in the calf region and on the outer surface of the thigh. The tumor mass was removed en bloc together with the left superior ramus of the os ischii which the mass was attached not far from the pubis. The muscles and fascia thus deprived of their attachment were pulled down and attached to the ischiopubic ramus.

Convalescence was uneventful except for an attack of phlebitis which was brought under control by lumbar infiltrations. For 5 months after the operation the patient was perfectly well.

Histologic diagnosis was of a simple enchondroma, well encapsulated, without evidence of calcification or of histologic evidence of sarcomatous degeneration.

The authors believe that the chondromas which appear on the basis of osteogenic exostoses harbor a certain degree of malignancy. However they have been able to find not more than 13 authentic examples of this type of malignant degeneration in the literature and they therefore feel compelled to an extreme reserve in their pronouncements. Nevertheless the rapid growth speaks for a malignant tendency and these tumors must be regarded as somber prognostic possibilities. About a third of the patients whose cases have been published obtained a lasting cure although not all of the patients who were treated successfully died of the tumor effects. The age of the patient seems to be of prognostic value; that is the tumor is perhaps a little less formidable in patients under 30 years of age.

Treatment consists entirely of surgical removal of the rapidly growing neoplasm. This removal is done conservatively leaving the amputations and disarticulations for the enormous masses in those cases with local complications demanding more radical procedures.

JOHN W. BRENNAN, M.D.

**Cystlike Lesions of the Carpal Bones, Associated with Ununited Fractures, Aseptic Necrosis, and Traumatic Arthritis.** A. K. ROBINSON and DAVID B. PHILLIP. *J. Bone Surg.* 1948 30-A: 151

The authors report 3 cases of cystlike lesions of the carpal bones, associated with ununited fractures of the navicular bone (2 cases) and with repeated occupational trauma of the wrist and aseptic necrosis of the capitate (1 case). Bunnell describes several cases in his book and attributes the changes to disturbance of the blood supply to the affected bones.

Case histories, roentgenograms, gross and microscopic pathologic changes and discussion are given. Attention is called to the similarity of cysts of the carpal bones to those of the capital femoral epiphysis and their pathogenesis may be assumed to be essentially the same. The carpal cysts bear some resemblance to subcortical cystlike areas in the femoral head and in the acetabulum at the weight bearing region in chronic degenerative arthritis.

In each case sufficient time had elapsed for advanced revascularization and replacement of the necrotic bone. Each case showed histological evidence of aseptic necrosis in the shell of bone about the cyst. Microscopic sections are illustrated showing the principal changes of the necrotic shell of bone: degenerating articular cartilage, creeping substitution of the cortex, fibrous replacement of the central portions of the bone, necrotic spicules of bone and partially calcified fibrous tissue.

Treatment consisted of surgical exploration of the wrists through dorsal incisions with curettage of the

cyst cavities and partial osteotomies of the affected bones. The ununited fractures of the navicular were not disturbed.

Although degenerative arthritis of the radiocarpal joint was demonstrated in each case preoperatively functional results were considered satisfactory.

KENETH H. SPONDEL, M.D.

**Late Manifestations of Occult Lumbosacral Spina Bifida** (Späterscheinungen bei Spina bifida occulta lumbosacralis). M. ZIEHNER. *Deutscher chir. Acta* 1947 14: 461

The observation of 3 patients with late manifestations of occult lumbosacral spina bifida led the author to conclude that two types of the condition can be distinguished: (1) the urologic form, characterized by a sacral incontinence of mechanical origin and (2) the orthopedic form, which produces sensory and neurotrophic disturbances in the lower extremities. Sacral incontinence points to the location of the lesion in the intermediate nuclear zone of the upper portion of the sacral spinal cord between the anterior and posterior horns, while a lesion in the posterior horns or posterior roots is responsible for sensory and neurotrophic disturbances.

Adhesions of the spinal cord in the dorsal cleft area of the lumbosacral portion of the spinal column represent the most important pathologic-anatomic findings. The most frequent site of the incomplete fusion is the caudal invagination of the embryonal neural cord and the pars caudalis. In addition to adhesions, intraspinal occult hernias, myelocoele and meningocele resulting from the incomplete fusion may exert pressure on the nerve tissue. Furthermore, the formation of adhesions and proliferations by the fat and connective tissue within the cleft may be responsible for pressure symptoms.

The late complications are due to the stretching of the adherent caudal portion of the spinal cord caused by the longitudinal growth of the spinal column and the spinal canal in contradistinction to the stationary position of the spinal cord or its normal retraction in the cranial direction.

Irreparable lesions of the nerve tissues and their clinical results can be avoided only by an early recognition of the late manifestations of spina bifida and prompt surgical intervention.

JOSEPH K. NARAT, M.D.

**Ischemic Necrosis of the Anterior Crural Muscles.** GEORGE S. PHALEN. *Ann. Surg.*, 1948 127: 118

Three cases of localized ischemic necrosis of the anterior tibial muscles are presented. Two of these were secondary to traumatic occlusion of the anterior tibial vessels, but the etiology in the third case could not be determined. Impairment of the anterior tibial vessels may be of a degree sufficient to produce gangrene of the anterior crural muscles. In the cases which are associated with fracture of the tibia or fibula, the anterior tibial vessels may have been damaged irreparably at the time of the original injury, even though the fracture may show little com-

minution or displacement and the trauma producing the fracture may have been of a minor character.

Anatomically several factors may enhance the possibility of damage to the anterior tibial vessels in cases of trauma to the leg. The origins of the anterior and posterior tibial arteries are quite rigidly fixed by surrounding structures so that they are subject to injury not only by direct violence but also by force transmitted to the bifurcation of the popliteal artery from other parts of the leg. The anterior tibial artery passes to the front of the leg through a relatively small aperture above the upper border of the interosseous membrane. The vessel might be damaged by any trauma transmitted to this site. At this location, too, the vessel lies close to the medial side of the neck of the fibula and might be traumatized easily by a jagged fragment of bone when the head and neck of the fibula are fractured. Finally the thick deep fascia of the leg, the anterior intermuscular septum, the interosseous membrane and the tibia and fibula rigidly enclose the tibiales anterior, extensor hallucis longus, extensor digitorum longus and peroneus tertius muscles. The anterior tibial vessels and the peroneal nerve enter this compartment and may be secondarily damaged by pressure produced by swelling within this tightly enclosed space.

In one of the author's cases the correct diagnosis became obvious because of the extensive loss of skin overlying the anterior crural compartment. The diagnosis in the 2 other cases, however, was not made until the anterior crural muscles were explored surgically. In 1 instance 2 months after the onset of symptoms, and in another one month after injury surgical intervention was undertaken. The author indicates that measures directed toward restoration or improvement of the local circulation in the lower leg might prevent or at least reduce the extensive gangrene of muscle tissue. Lumbar sympathetic blocks are valuable in almost any case of arterial spasm. If these are not successful surgical exploration of the anterior tibial vessel should be considered and either periarterial sympathectomy or arteriectomy should be done to improve the collateral circulation. Extensive fasciotomy of the anterior crural fascia may be necessary to relieve the increased pressure within the closed compartment.

The surgeon is cautioned that extreme care must be taken not to introduce any pyogenic organisms since once such organisms have been inoculated into a bed of necrotic muscle (as was done in case 1) the infection cannot be controlled until all the necrotic tissue has been removed.

If the anterior crural muscles have been damaged irreparably tendon transplantation may restore adequate extension to the foot and enable the patient to walk without a brace. Either the posterior tibial muscle alone or preferably this muscle in combination with one of the peroneal muscles, may be used. Arthrodesis of the ankle joint or even arthrodesis of the subtalar joint should not be necessary in a case of this type.

C. FRED GORDON, M.D.

#### Hypermobile Flatfoot with a Short Tendo Achillis.

ROBERT L. HARRIS and THOMAS BEATY, *J Bone Surg* 94B, 30-A, 116.

The purpose of this article is to report certain recent observations regarding flatfoot, and particularly to discuss the relationship between the architecture of the tarsus in severe flatfoot and the impairment of function resulting therefrom.

During 1944 and 1945 the Royal Canadian Army Medical Corps conducted an extensive survey into army foot problems, which included the careful and detailed examination of the feet of 3,600 recruits, with subsequent re-examination. It became evident that pes planus must be divided into at least three varieties: (1) the severe and disabling type discussed in this article; (2) peroneal spastic flatfoot, also gravely incapacitating; and (3) simple depression of the longitudinal arch which is of little consequence as a cause of disability.

Clinical manifestations of hypermobile flatfoot with a short tendo achillis include a history of deformity from childhood. Symptoms usually appear during adolescence and disability increases with age. The feet are flat only on weight bearing. The shortness of the tendo achillis causes limitation of dorsiflexion at the ankle joint. The limitation of dorsiflexion is concealed on casual observation because of the hypermobility of the subtalar and midtarsal joints. Unless the heel is prevented from going into valgus and the forefoot from abduction the actual limitation of dorsiflexion at the ankle joint cannot be determined. There is instability of the subtalar and midtarsal joints.

The characteristics of the deformity are described. The head of the talus is thrust downward and inward; the calcaneus is tilted into valgus, and the forepart of the foot is swung outward in relation to the hindfoot.

The incidence of this condition in 3,619 soldiers was 25 with severe deformity and 193 with mild deformity. Peroneal spastic flatfoot was diagnosed in 74 individuals and all other cases of low arch amounted to 324.

The anatomical features were studied in 200 cadavers at the University of Toronto. The conclusion was reached that weak support of the head of the talus is the cause of the deformity. Excellent illustrations are provided to demonstrate this view. Roentgenograms of the feet of 3,619 soldiers confirmed the conclusions regarding the instability of the talus on the calcaneus.

The conception that the function of the foot and its shape under the stress of weight bearing depend chiefly upon the design of the tarsal bones and their position in relation to each other is compared with the hypothesis of active support of the foot by muscle power.

A general plan of treatment is outlined. Conservative care is given in mild and severe cases until late adolescence and maturity. This consists of boot adjustments of an elevated heel, a medial border wedge on both sole and heel, the Whitman support,

and muscle exercises. Activity should be guided within the capacity of the patient. Should reduced activity and conservative measures fail in late adolescence and adulthood surgical arthrodesis of the subtalar and midtarsal joints with the foot in corrected position should be accomplished. Lengthening of the tendo achillis is apparently not deemed necessary or desirable. KENATH H. SPONSEL, M.D.

### SURGERY OF THE BONES, JOINTS, MUSCLES TENDONS, ETC.

**Repair of Major Tendon Ruptures by Buried Removable Suture.** HARRISON L. McLAUGHLIN. *Am J Surg* 1947 74 758.

A method of internal fixation for fractured tendons utilizing the removable traction suture principle evolved by Bunnell was carried out in 6 lesions of the quadriceps mechanism and 8 lesions of the tendo achillis. The associated muscle components are among the strongest in the body so that marked retraction of the proximal tendon fragment is the rule and these muscle forces must be overcome and controlled before restoration and maintenance of the anatomy can be accomplished. When the lesion has been present for some weeks or months as is not infrequently the case extensive cicatrization of the whole local area and a relatively fixed contracture of the retracting musculature make the treatment problem still more difficult. In all cases even after surgical repair has been accomplished successfully, the normal functional demand which ambulation places upon the major tendons of the lower extremity has made maintenance of function throughout the healing period difficult to accomplish without seriously jeopardizing the integrity of the suture line. The author stresses that tendon repair requires accurate and snug apposition of healthy to healthy tissue without tension at the repair site with a minimum of foreign material (whether suture material, fascia, or dead tendon fibers) at the healing site and a maximum maintenance of function throughout the healing period.

The technique involved in the repair of the tendo achillis and the repair of the quadriceps mechanism is adequately described.

The wound is closed in layers over the entire fixation apparatus. Both ends of the bolt and the lead shot on the removing wire occupy a relatively subcutaneous position and remain easily palpable. Removal requires a small incision at each of these three palpable points. Local infiltration with procaine hydrochloride provides adequate anesthesia for this purpose. The terminal ends of the main suture are divided and the bolt mechanism is unscrewed and removed through the two distal incisions. The lead shot is then identified by palpation and the remainder of the apparatus withdrawn through the proximal incision by traction on the removing wire.

In the postoperative management of repair operations performed on the quadriceps mechanism the

extremity is put at complete rest for from 48 to 72 hours and then placed in balanced suspension. All joints except the knee are mobilized fully. The knee is mobilized through the arc predetermined at operation.

When the operative wound has healed ambulation with weight bearing is begun with the involved knee protected by an extension splint or brace. The internal fixation apparatus is removed 8 weeks following operation. At the same time all external protection is removed and progressive resumption of normal activities encouraged. As a result of early mobilization followed by subsequent continuous active function the penalties of restricting joint motion by the protective splint or brace are minimized and ambulation is made safe and possible throughout the period required for tendon healing. The results in 4 patients treated by a removable traction suture are tabulated.

In the discussion of this article, Sterling Bunnell described the use of various metal suture materials in such cases. Stainless steel wire for tendon sutures causes the least tissue reaction and tends not to produce adhesions. Tantalum is unfit as it is brittle and rough. After 3 or 4 weeks the suture should be withdrawn as by then the tendon has become physiologically united and any suture material is just an irritating foreign body. A word of caution was inserted concerning the use of the pull-out wire. This should not have a large loop as tissue may grow through it and hinder its withdrawal. To prevent this the loop should be closed, but not too tightly as it may break. If the suture does not withdraw the application of a rubber band will usually lead to delivery of the wire over night.

C. FRED GORRINGE, M.D.

**Excision of the Elbow Joint.** W. H. KIRKALDY WIL. *118. Lancet* Lond. 1948 1 53.

The author presented case reports on 14 Kenya patients in Nairobi of whom the elbow was resected. This procedure produced a reasonable proportion of useful joints over a 20 year period.

The indications for this operation are given by the author as follows: (1) tuberculosis when excision of the joint removes the focus of disease and gives a full range of painless movement many months before a sound ankylosis could be produced; (2) recent comminuted fractures; (3) old unreduced fracture dislocations; and (4) osteoarthritis following injury to the joint. Postoperatively there should be no more than 50 degrees of limitation of flexion or extension, and in most of the cases there should be a full range of movement. The cases were divided into three groups on the basis of prognosis.

In recent comminuted fractures, old unreduced fractures involving the joint, fracture dislocations, and early cases of tuberculosis, recovery should be rapid and uneventful, and full movement with good lateral stability and good power of the triceps and biceps should be obtained within from 3 to 6 months after the operation. In most cases of tuberculosis re-



covery is slower because of the wasting of the triceps and biceps, and therefore a further 1 or 2 months will elapse before the power in these muscles and the lateral stability of the joint are adequate. In the second group a full range of movement is more easily and rapidly obtained than in the first. The third group includes comminuted fractures around the elbow accompanied by gross injury to another part of the body ankylosis with wasting of the triceps and biceps, and tuberculosis with secondarily infected sinuses.

General anesthesia has been the rule but brachial plexus block was used in one case. A pneumatic cuff tourniquet is applied to the upper arm. The arm is held by an assistant across the patient's chest, the posterior aspect thus being uppermost. The surgeon stands on the side of the patient opposite the affected elbow. A 5 inch midline posterior incision is made centered over the tip of the olecranon, and carried down to the deep fascia. Skin towels are then applied. A nontouch technique is used throughout. An excellent detailed description of the operation is given.

The drain is removed after 2 days, and the stitches after 14 days. After 4 days the arm is flexed to 45 degrees on the adjustable splint. After a further 3 or 4 days it is extended to 45 degrees beyond the right angle, and then alternately flexed and extended at similar intervals until 3 weeks have elapsed when the splint is exchanged for an arm sling. The chief purpose of the splint during these 3 weeks is to control lateral movement of the elbow. In about 30 per cent of these cases there was a weakness of the muscles of the forearm, especially of the extensors of the wrist and fingers, which disappeared after from 10 to 14 days. In these cases a plaster cock-up splint was applied for 3 weeks.

At the end of 3 weeks the patient is ready for rehabilitation. The arm sling is worn for 2 weeks to prevent lateral movement of the false joint. In fractures and early tuberculosis it is discarded at the end of this time. In advanced tuberculosis and when there is gross wasting of the biceps and triceps it may be required for a period of several weeks or even 2 or 3 months.

After the first month of physical therapy the patients who had fractures are instructed to saw wood each day. The tuberculous patients are given this exercise after 2 or 3 months. In the fracture cases the patients can flex and extend the elbow against resistance and control lateral movement of the joint after 3 or 4 months they are then discharged. The fact that the patients can use the affected limb for sawing logs gives a fair estimate of its future usefulness.

In one instance a gross fibrosis of the biceps and triceps developed 5 months following the reaction of the elbow. An arthrodesis of the elbow was then performed. Prior to the latter operation there was passive motion over the full range of motion. This was the least successful result in the entire series.

C. FRED GORDONER, M.D.

Epiphysiolysis of the Hip. Discussion and Results (Epifisiolisi dell'anca. Considerazioni e risultati). A. ZARATTINI. *Chir. org. mod.* 947 31. 269.

The term "epiphysiolysis" is applied to the first stage of the condition which leads to coxa vara or valga, according to the predominating static and dynamic factors. In the majority of cases in children coxa vara results.

The author draws the following conclusions from his observations on 10 cases.

The onset of this condition is slow and offers great diagnostic difficulties in the beginning.

The relations between trauma and epiphysiolysis are obscure. Apparently endocrine disorders play an important role in the pathogenesis of the condition but the exact mechanism of the effect is still unknown. The intimate genesis of the osteochondral dysplasia requires further investigation.

The author rejects open reconstruction of the femoral neck, using metal for osteosynthesis although some writers advocate the method even in early stages of the disease. The surgical trauma causes a grave disturbance of the local trophic conditions and therefore the operation should be reserved only for exceptional cases. Whenever possible, arthrotomy should be avoided and subtrochanteric osteotomy done.

Bloodless reduction according to the Lorenz-Whitman method, combined with multiple perforations of the femoral neck, usually furnishes excellent results.

JOSEPH K. NARAT, M.D.

## FRACTURES AND DISLOCATIONS

Internal Contact Splint. G. W. N. EGGERS. *J. Bone Surg.* 94B, 30-1 40.

On the basis of bone atrophy at the site of fracture and the presence of inactive devitalized interfractural tissue delayed or even nonunion may follow when rigid commercial bone plates are used. During a deep anesthesia, the fascial as well as the muscle components are relaxed. At the cessation of narcosis the muscular tone returns and the combined longitudinal forces induce a sustained contact during the healing phase. If a gap has been created by distraction or absorption of the fractured ends, nonunion or delayed union is inevitable. Assuming that nonunion may ensue solely from rigid bone plates, the author has introduced a new plate which permits gliding of bone if and when shortening of the bony fragments occurs. Attention is drawn to the high frequency of nonunion of the tibia when the fibula remains intact. Similarly fracture of one bone of the forearm without the other is not infrequently associated with delayed union or nonunion. The involved mechanism is alleged to be an absorption or attrition of the fractured ends without compromise and resulting in an anatomical defect. Nonunion occurs.

Advantages of the internal contact splint are  
1. The fragment ends are easily placed together in exact approximation the muscle pull will maintain the desired contact.

2. Oblique fixation screws across the fractured ends are eliminated. Hence the fragment ends do not receive additional surgical trauma.

3. Impaction of the fragment ends is undesirable physiologically and unnecessary. It provokes attrition.

4. Absorption of the bone fragment ends is automatically compensated for by longitudinal muscle tone.

5. Fewer screws are necessary. Hence there is less bone trauma.

6. The internal bone splint is flat and pressure on the bone and periosteum is minimal.

7. There is less stress on the splint to break or bend at the fracture site. Dead space is eliminated by the telescoping mechanism permitted by the author's bone plate.

The article is replete with many roentgenological studies of long bone treated by this technique. Additional photographs show the method of testing beyond reasonable doubt, the longitudinal gliding of the screws and splint.

SAMUEL L. GOVERNALE, M.D.

#### Operative Therapy for Slipped Upper Femoral Epiphysis. An End Result Study. CARL E. BADOLEY, A. S. ISAACSON, J. C. WOLGAST and J. W. MILLER. *J. Bone Surg.* 1948, 30-A, 19.

In the treatment of displaced femoral epiphysis the authors have governed their therapy of 78 hips by the following principles.

1. A displacement of not more than one third of the diameter of the femoral epiphysis is treated by internal fixation without correction of the "preslipping" femoral head.

2. Greater displacement than in the preceding paragraph and associated with deformity and disability is dealt with by corrective operative procedures.

3. Skeletal traction for the traumatic and early slipping produces the most satisfactory results. For the maintenance of reduction mild manipulation and internal fixation is advocated.

4. For unsuccessful skeletal traction open reduction with a wedged osteotomy and a pin or screw fixation of the slipped epiphysis is practiced (in this group).

5. The ultimate result in cases of neglected and displaced femoral epiphysis is degenerative arthritis. Subtrochanteric or intertrochanteric osteotomy is reserved for this class of hip deformity. The authors treated 34 of the 78 hips by open reduction, removal of an anterior cuneiform wedge of bone and fixation by means of a Smith Petersen nail or by two screws. Eleven patients were subjected to an osteotomy at the epiphyseal site for the correction of deformity. Reduction was maintained by means of external fixation with a plaster spica. Four patients were subjected to osteotomy for alignment of the existing epiphyseal neck derangement. Six patients were treated by closed reduction, mild manipulation and blind nailing. Sixteen hips were fixed

internally with no attempt to correct minor displacements and 4 hips were corrected by the Schanz osteotomy.

The exposure of the hip is accomplished by the anterior Smith Petersen cup arthroplasty approach. The iliopsoas muscle is exposed cut and retracted medially. An excellent exposure of the anterior acetabulum is thus obtained. If possible the labrum glenoidale should be preserved. In order to aid in the location of the osteotomy level the anterior periosteum should be reflected care being taken however not to strip or injure the posterior perosteal elements as irreparable circulatory damage may ensue. Since in former years external fixation of similarly treated cases with a plaster of Paris spica resulted in 50 per cent of failures internal fixation with the Smith Petersen nail or screw is now done routinely. In the postoperative care adequate wound healing should be considered. Early ambulation is recommended and weight bearing should be possible 3 months after operation.

The aggregate clinical results attained by the combined operative procedures mentioned were excellent in 43 patients (57%) good in 8 (11%) fair in 1 patient and poor in 23 patients or 31 per cent. The end results in 38 patients treated by open reduction with internal fixation were graded as excellent in 21 (55%) good in 4 (11%) fair in 1 patient and poor in 12 patients.

The complications encountered by the writers were those of degenerative arthritis in 18 patients (23%) aseptic necrosis in 3 (4%) nonunion of the epiphysis in 1 patient (1%) and crushing of the neck in another. The latter complication resulted from an overzealous forceful manipulation of the deformity a preventable complication indeed.

In conclusion the authors assert that open operative correction by transcervical osteotomy and internal fixation yields the best chances for a good functional hip. When a slipped femoral epiphysis with malunion existed normal restoration of the femoral head and neck relationship by surgical means resulted in permanent good hip function in 68 per cent of the cases operated upon by the authors method.

SAMUEL L. GOVERNALE, M.D.

#### Disturbance of Longitudinal Growth Associated with Prolonged Disability of the Lower Extremity. DONALD ROSA. *J. Bone Surg.* 1948, 30-A, 103.

This article is concerned with premature closure of the growth cartilages at the knee in patients who have had prolonged dysfunction of the lower limb. It is based on the study of 13 patients of whom 9 had tuberculosis of the hip. Each of the others had pyogenic arthritis of the hip, a slipped capital femoral epiphysis, poliomyelitis or osteomyelitis of the shaft of the femur. Inequality of limb length resulting from growth retardation and not entailing premature closure of epiphyseal cartilage is not discussed herein.

In the cases here recorded the site of the growth arrest at the knee varies. In 5 patients, growth arrest

occurred in both the distal femoral and proximal tibial epiphyseal plates. Premature closure of the distal femoral disc occurred centrally in all 5 but in the tibial disc it occurred peripherally in 4, and centrally in 3. In 8 patients growth arrest of only the proximal tibial epiphyseal cartilage developed. Peripheral fusion occurred 6 times and central fusion twice. Seven of the peripheral arrests occurred in the posterior medial quadrant and 3 in the anterior quadrant of the tibial plate. The proximal fibular disc was not affected in any case which led to relative lengthening of the fibula proximally.

The 13 case histories are presented and representative roentgenograms are reproduced. Inequalities of leg length up to 17 cm are recorded. Photomicrographs of a prematurely uniting tibial epiphysis and its normal corresponding proximal fibular epiphyseal plate are reproduced.

Roentgenographic evidence of growth disturbance at the knee is usually present prior to the development of marked inequality of limb length or alignment deformity. The early changes are not observed unless repeated roentgenographic examinations are made from the onset of the disability to the end of the active growth period. Seven cases in this group were followed up for this length of time.

The early alterations of the epiphyseal cartilage are thinness of the epiphyseal disc and the presence of a transverse zone of dense bone on its metaphyseal aspect. Growth retardation scars are numerous and osteoporosis of the regional bone is pronounced. The contour of the epiphyseal cartilage is irregular with one or more peaks projecting into the metaphysis. Such changes may precede actual cessation of growth but in some cases, recovery of normal longitudinal growth occurs.

In the distal end of the femur the point of arrest is commonly posterior to the central portion of the disc. The remaining disc may continue to grow causing posterior rotation of the condyles. In the proximal end of the tibia the arrest is often in the posterior medial quadrant, in which case continued growth of the remaining cartilage results in tibia vara. When the tibial tubercle unites prematurely tibia recurvata occurs.

The essential pathological change is degeneration of the epiphyseal cartilage and its replacement by bone.

Prevention of growth deformity in chronic diseases of the lower extremity is not always possible. Measures to shorten the duration of disability from hip disease (such as operative fusion), avoidance of prolonged immobilization and careful supervision of the patient who resumes weight bearing on a limb which has undergone marked osteoporosis may minimize the chance of growth arrest. Epiphyseal arrest operations, osteotomies or leg shortening or lengthening procedures may be necessary for the best results in these cases. If asymmetrical growth arrest has occurred, alignment deformity must be prevented by producing a complete arrest of growth in that epiphysis by surgery.

Although the growth-retardation changes discussed are more pronounced at the more rapidly growing epiphyseal plate at the distal end of the femur actual premature closure was observed more frequently in the proximal end of the tibia.

Gill had suggested that this bridge across the epiphysis forms as a result of a rupture of the epiphyseal disc when the normal support of the disc collapses with fracture of the adjacent atrophied trabeculae. An alternate explanation of the growth arrest in these cases is that the already partially degenerated cartilage is unable to withstand the abnormal stresses of a faulty gait. The cartilage wears through at the point of greatest stress and allows bony union of the epiphysis and metaphysis. In favor of this is the high incidence of growth arrest in the posterior medial quadrant of the proximal tibial plate, and the fact that growth arrest never occurred in the fibula, which is unimportant in weight bearing.

KIMMEL H. SPORRELL, M.D.

### ORTHOPEDICS IN GENERAL

An Anatomical Study of the Mechanics, Pathology and Healing of Fracture of the Femoral Neck. A Preliminary Report. ALADAR FARKAS, MILTON J. WISLOW and J. CLIFFORD HAYTER. *J Bone Surg* 94B 30-A 33.

This article is based upon gross microscopic and roentgenologic anatomical studies of numerous femurs both fractured and unfractured. Special emphasis is placed upon the lamellar bone system within the neck of the femur. The authors undertook this study because they believed that the answer to the problem of injuries and healing of the femoral neck was dependent upon the condition of the internal weight bearing system of the lamellar bone within the neck of the femur. They noted that abduction fractures are caused by falls or compression of the trochanteric region, whereas adduction fractures are often or usually produced by trivial trauma.

The authors have demonstrated an uninterrupted lamellar system, which they term "the internal weight bearing system of the femur" running from below the lesser trochanter to the region of the cartilaginous plate of the femoral head. This system becomes merged with the cortex at the posterior femoral neck and from that point proximally it tends to fan out into a diffuse weight bearing system which ends at the cartilaginous plate of the femoral head. There is a reciprocal relationship between the strength of this structure and the cortical shell. The system is weakest where it fuses with the posterior cortex of the neck, and at this point the cortex is strongest. The system is strong where it enters the head in fanlike fashion and at this point the cortex is thinnest. The internal weight bearing system starts to undergo slow resorption after middle age, but it never disappears entirely. In advanced age the system is composed of laminae throughout its course. The proximal end becomes sparse. The reddish color of the distal portion of the internal

weight bearing system seen in younger individuals becomes whitish in the aged

This bone system is significant for three reasons

- 1 It is intimately connected with weight bearing
- 2 It is the chief source of bone repair
- 3 Its partial resorption in old age is the main pathological factor preceding fracture of the neck of the femur

This system has been written up by previous investigators under various names such as *calcar femorale* and *lamina femoralis interna*. The proximal portion of this system has been shown to be missing in primates and quadrupeds. In pathological conditions in which the line of weight bearing changes, this lamellar system changes accordingly. The authors believe this system is a pure compression system, having nothing to do with tensile stresses which they do not believe are important in the physiology of the hip

This internal weight bearing system consists of laminae sandwiched between layers of bone marrow and is ideal for speedy repair after injury if it is strong and healthy and in close apposition. If the structure is pathological healing will probably not take place.

In abduction fractures the internal weight bearing system breaks at about the middle of the neck but the cortex breaks at the cervicocapital juncture. Often in this type of fracture the internal weight bearing system is not completely broken but is "greenstick" in type, and heals rapidly even without treatment. Often there is impaction of such fractures.

The roentgenographic signs in fracture of a hip with a normal internal weight bearing system show (1) that the laminae are numerous and densely packed and (2) that the proximal fragment of the

internal weight bearing system is long and blunt, but not pointed

Adduction fractures occur in the subcapital region and the separation line of the cortical fracture and those of the internal weight bearing system are in the same plane. When the marrow deteriorates the proximal end of the internal weight bearing system loses its blood supply and separates pathologically. The distal ends of the system are intimately related to the cortex and draw their nutrition from the capsule and periosteum.

There are two distinct types of fractures of the neck of the femur

- 1 Compression fractures in which the internal weight bearing system is healthy
- 2 Subcapital separations with subsequent fracture of the cortical shell (These are always adduction fractures)

The first type according to these authors may heal in from 4 to 8 weeks with good apposition and fixation. The second type requires either replacement of the internal weight bearing system by bone grafting or its stimulation by biological mechanical or perhaps chemical means. Nailing or drilling seems to stimulate new bone formation. Accurate contact between the conical end of the proximal fragment and the distal portions of the lamellar system, or the graft which replaces this system is essential. The authors use a perforated graft from the femoral shaft just distal to the trochanter. The spongy side of this is faced posteriorly and has been successful in promoting union.

This article is accompanied by numerous photographs of anatomical specimens, which the authors prepared. Illustrative roentgenographs and photomicrographs also are furnished in support of the authors' conclusions. NEWTON C. MEAD M.D.

# SURGERY OF THE BLOOD AND LYMPH SYSTEMS

## BLOOD VESSELS

**Ligation and Division of the Abdominal Aorta for Metallic Embolus from the Heart** FAR RUC W. COOPER JR., M. D. ILL. 112, 113, and J. W. KANE A. Surg. 945 171

The authors review briefly the history of ligation of the abdominal aorta (an aneurysm first reported by Sir Astley Cooper in 1817). Thirty-six cases of partial or complete ligation of the abdominal aorta appear in the literature, and in 13 of these successful results were obtained.

The case reported by the authors is the only one in which excision of the bifurcation of the aorta was necessitated by erosion of a portion of the wall of the aorta by a foreign body within its lumen. An uneventful clinical recovery occurred. The patient was a 22-year-old male soldier who sustained a penetrating wound of the left arm and chest beneath the left axilla with a .45 caliber pistol. Roentgenogram showed the foreign body in the heart. Later it was shown to have been carried to the bifurcation of the aorta. A detailed discussion of the clinical report of the patient together with the operative procedure is presented.

The authors note that the evolution present in this case gave rise to a sequence leading to ligation of the aorta. The patient was young with normal elasticity of youth. Occlusion of the aorta was not sudden but progressed rapidly over a period of several weeks with various signs of the completeness of obstruction to blood flow. Finally at the time of operation the vessel had become completely occluded and adequate collateral circulation had been established. Operation in this instance actually immediately improved the circulation in the legs as shown by the prompt rise in skin surface temperatures of the toes.

Occlusion of the vessel was accomplished with No. 00 braided silk ligatures followed by complete division of the aorta. It is believed that with ligation and division of the large vessel ligatures of small size may be used with safety.

HERBERT F. THURSTON, M.D.

**Control of Arterial Hemorrhage by a Gelatin Sponge Cuff and Chronic Surgical Gut Sheath: A New Experimental Method** HILLER PERRY, JACKSON EDWARDS, Sr., HOWARD OWEN, and ROBERT JACOBSON. Arch. Surg. 947 55 637

Reports on the management of vascular injuries in the recent war indicate that in only a relatively small proportion of the acute arterial injuries has it been feasible to resort to suture anastomosis or vein graft with the aid of vitalium tubes. The results in these cases from the standpoint of the prevention of gangrene have not been especially satisfactory as compared with the cases in which ligation was done.

In view of the satisfactory results which were obtained in the control of hemorrhage from wounds of

the vena cava and other veins in dogs by the gelatin sponge patch, it appeared plausible to attempt control of arterial hemorrhage with this new hemostatic agent. A technique was devised which consisted of wrapping a "cuff" of dry compressed gelatin sponge about the wound in the artery and surrounding this with a sheath of chronic surgical gut. With this method it was possible to control hemorrhage and restore blood flow in wounds of the aorta (in experimental animals) without having to resort to arterial suture.

A cuff was made of dry gelatin sponge which had been compressed with the fingers until it was pliable and could be rolled into the form of a tube. When such a cuff was used alone or held only by sutures, the gelatin sponge was rather easily fragmented and blood clots occurred. In 16 animals in which the gelatin sponge cuff was supported by a sheath of chronic surgical gut there was only one blowout from the arterial wound. In one instance, however, a large propagating thrombus was adherent to the wound in the vessel wall. Induration of the tissues was observed about the heath in several instances.

Microscopic studies revealed healing of the wound in the wall of the vessel by scar formation which was covered by a newly formed intima. The chronic surgical gut sheath was found to be present in varying stages of absorption. The gelatin sponge was generally found to be in more advanced stage of absorption than the surgical gut sheath.

The authors suggest that this experimental cuff technique might have some clinical application in circumstances in which a satisfactory arterial repair is not feasible by the standard suture technique. It is probable that its most potential field of usefulness would be as an additional guard against blowout of an arterial suture line. THORGEOR B. MASTERS, M.D.

**Restoration of Endoneurysmorrhaphy by Vein Graft Inlay** ARTHUR H. BLAKEWORTH, A. M. Surg. 1947 16 841

For the cure of aneurysm of the extremities the salient feature of the technique advocated by Masters is the preservation of collateral vessels through an intravascular approach. It is the wish of the author to present herewith a technique of vein graft inlay for the repair of degenerative arterial aneurysm with restoration of the blood flow which conserves the principle of minimal damage to the collateral vessel. The technique of the procedure is described.

While one operator is exposing the aneurysm and securing free access to the proximal and distal poles, the assistant surgeon proceeds with the removal of a segment of vein for use as a graft—preferably from another extremity. The superficial femoral vein is most commonly used. When the afferent artery is located and isolated by blunt dissection a double turn of vaselined umbilical tape serves well

for temporary occlusion of the artery. The efferent parent artery is likewise identified and controlled. The aneurysm sac is then opened widely from pole to pole. The clot is evacuated and a search is made for openings of vessels within the sac. All vessel openings exclusive of the parent artery openings are sutured with three zero Deknatel silk from within the sac. The distance between the parent artery openings within the sac is measured. To this measurement 4 cm. are added for the correct length of the vein graft to be used to bridge the arterial defect.

Vitalium tubes, as recommended in a nonsuture method for vein graft bridging of arterial defects serve as a prosthesis for retention of the vein graft inlay. On account of vein valves the proximal end of the vein graft should be joined with the distal artery opening. A series of drawings are presented to illustrate the different stages in this technique.

Four cases are presented in detail and it is of interest to note that analysis of the 4 cases operated upon by the vein graft inlay technique revealed the restoration of a pulsating arterial blood flow with the salvage of all important collateral vessels.

The author concludes that in the light of the facts presented it is to the best interest of the patient to restore a pulsating arterial blood flow if it can be accomplished without damage to the important collateral vessels. Endoaneurysmorrhaphy with a vein graft inlay restores a pulsating arterial blood flow without damage to important collateral vessels.

HERBERT F. THURSTON, M.D.

### BLOOD TRANSFUSION

**A New Technique for Replacement Transfusion in the Treatment of Hemolytic Disease of the Newborn Infant.** DOUGLAS P. ARKOLD and KENNETH M. ALFORD. *J. Pediat.*, St. Louis, 1948, 32: 113.

Replacement transfusion rids the blood stream of the infant with hemolytic disease of the newborn to

a considerable extent of Rh antibodies products of hemolysis, and of red cells of the infant which are sensitized to otherwise compatible serum of the adult.

Ordinary transfusions do not accomplish this. A replacement transfusion should be done as soon after birth as is possible. Early thrombosis makes umbilical vein transfusion impossible after the first 12 hours of life.

There is no superficial vein in the infant large enough to obtain blood rapidly and in sufficient quantity. The authors describe a technique whereby the greater saphenous vein is used high in the thigh. An incision is made medially and parallel to the inguinal ligament from 1 to 1.5 cm. below a point bisecting a line joining the anterior superior iliac spine and the pubic tubercle. The vein is exposed and ligated distally. One of Diamond's plastic catheters is inserted through the exposed saphenous vein into the femoral vein or inferior vena cava. When an adequate pool of blood is encountered 500 c.c. of blood are exchanged 20 at a time. This effects an 80 to 85 per cent transfer. Clotting within the apparatus is prevented by means of 150 c.c. of saline solution containing 10 mgm. of heparin per cubic centimeter but this is not allowed to enter the infant's circulation. Transfusion should take from 1.5 to 2 hours. In severe anemia from 20 to 40 c.c. more blood can be injected than is withdrawn. The blood which is transfused should be slightly warmed.

Following transfusion 10 c.c. of 5 per cent calcium gluconate are given to counteract the citrate used. The baby is kept warm and given oxygen during and after the procedure. Sulfadiazine (1 gr. per pound per day) and penicillin (3,000 units every 3 hours—intramuscularly) are then given prophylactically for 3 days. Also 1 mgm. of vitamin K is given by hypodermic injection every 6 hours for 4 doses.

JAMES WEAVER, M.D.

# SURGICAL TECHNIQUE

## OPERATIVE SURGERY AND TECHNIQUE; POSTOPERATIVE TREATMENT

The Value of Preoperative Heart Examination.  
WOLFRAM KOCK *Acta Chir Scand* 1947 96 199

In determining whether a surgical problem is one of operation or of expectance it is sometimes a purely internomedical factor which decides the question namely the status of the patient's heart. It seems reasonably obvious that careful study of the anamnesis, of clinical and cardi functional tests and of a consideration of the planned intervention together with the contemplated anesthetic and after course is of great importance in estimating what the patient can stand but to judge from reports in the literature a decision in this delicate question is not very easily made.

After citing some of the important studies of recent years dealing with the value of preoperative heart examinations the author gives the results obtained in a series of 406 routine consecutive general surgical cases in which detailed preoperative estimate of the cardiac status was made.

These cases involved the following organs and systems: the thyroid gland (100) the thorax, pleura, lungs, bronchi (44) the gall ducts, pancreas, spleen (53) the stomach and duodenum (49) the intestines, rectum and anus (59) and the kidneys and genitourinary tract (100).

Numerous tables are included which show the condition of the patients with respect to age, sex, previous cardiac history, physical and laboratory findings of cardiac aberration, electrocardiographic changes, and heart pathology as shown in roentgenograms and each table lists the incidence of postoperative heart complication. The frequency of pathological electrocardiographic and roentgenographic findings in patients who, from the history and physical examination were adduced to have a normal cardiac status is emphasized.

Insofar as anesthesia was related to postoperative complications lumbar puncture was most frequently involved, but here analysis is difficult in that 3 complications occurred following the use of local anesthesia.

Postoperative heart complication occurred in only one case in which the preoperative estimate had been of a normal cardiac status and in this case the issue was not fatal.

In the total series 12 deaths occurred and these were attributed to cardiovascular causes each case is described in detail. The author concludes that an adequate preoperative estimate of the cardiovascular condition of a patient is possible only when the complete anamnesis, physical findings and laboratory examination, as well as the electrocardiogram and roentgenogram of the heart are all considered.

WATNE F. CAMERON M.D.

Discussion on Postoperative Thrombosis. HENRY PAVLING WRIGHT, MAXIMUS HAINES, A. DICKSON WRIGHT, LESLIE WILLIAMS, and Others. *Proc. R. Soc. M. Lond.*, 1945, 41 17

WRIGHT concluded from studies on 4 patients following operation and delivery that increases in the fibrinogen B fraction and the prothrombin activity could not be used with any degree of accuracy to predict the onset of thrombosis. In 1942 she found that the platelets increased and became more adhesive following trauma incident to operation or delivery. This was most pronounced on about the tenth day. It was concluded that the increase in the stickiness resulted from the presence of the new young cell. The degree of elevation of the platelets was found to be dependent upon the amount of tissue damage and autolysis. By casting the iliofemoral segment of veins with plaster of Paris a marked anteroposterior flattening was observed where the vein passes over the pelvic brim. This was attributed to the vein lying almost directly on the bone and next to constriction by the inguinal ligament. The slowing of blood flow and nipping of the clot at this point were considered as possible factors in the formation of repeated emboli. In the Fowler position the vessels were found bent almost to a right angle. Currently studies are being carried out with radioactive isotopes on the rate of venous flow of the leg in an effort to further elucidate on the problems of stagnation in patients confined to bed.

HAINES reviewed the operations performed at the Chelsea Hospital for Women from 1927 to 1946 in order to ascertain the trend of fatal pulmonary embolism. Statistical analysis indicates that the chances were 40 to 1 that the death rate would fall in the second to year period as compared with the first and the best estimate of this fall was from 4.73 per 1,000 operations to 2.22 per 1,000.

WRIGHT favored interrupting the superficial femoral veins and using anticoagulant therapy preoperatively for individuals predisposed to thrombosis. This was also recommended if pulmonary embolism occurred. The common femoral vein is interrupted above the saphenous opening in the presence of thrombosis of varicose veins or normal superficial veins. Posterior tibial phlebotomy is treated by superficial femoral vein ligation at the junction with the deep vein on the affected side along with the usual anticoagulant therapy. Iliopsoas alba dolens calls for novocain block of the lumbar sympathetic ganglia. For iliac thrombosis lumbar ganglionic block and caval ligation are performed. Phlebography and thrombectomy are believed to be promising procedures.

WILLIAMS advocated anticoagulant therapy and paravertebral sympathetic block for any patient in whom venous thrombosis in the deep veins of the

leg is diagnosed. He did not, however urge early amputation or femoral vein interruption to save nothing of caval ligation.

BALL reviewed 46 cases of venous thrombosis and pulmonary embolism treated with anticoagulant drugs at Central Middlesex County Hospital. He found this regimen shortened the hospital stay to about 3 weeks and the stay in bed to about 1 week. Moreover the risk of pulmonary embolism appeared to be lessened and it seemed likely that the percentage of disabling after-effects would be markedly diminished.

GREEN ARMYTAGE pointed out that notwithstanding the attending trauma embolism and thrombosis rarely follow pelvic operations from below.

DWID H. LYON, M.D.

#### Anticoagulant Treatment of Postoperative Venous Thrombosis and Pulmonary Embolism. JAMES A. EVANS and JOHN F. DEZ, *England* *J. M.* 1948, 238, 1

Among 56,000 patients who underwent major surgical operations at the Lahey Clinic Boston the incidence of thromboembolic disease was 0.42 per cent (184 cases). In 33 per cent of the cases there was a warning pulmonary embolism. Not included in the 184 cases were 54 patients who died before the diagnosis had been made or treatment had been instituted. Among the group of patients who had had treatment, there were 6 fatalities. Of these 3 may be partially regarded as therapeutic failures. Hemorrhage following dicumarol therapy developed in 12 patients, with death of one patient. Since the use of anticoagulant therapy the mortality has been reduced to one fourth that for the year of 1945 and to one-half that for the year of 1946 in the same institution.

Anticoagulant therapy for venous thrombosis and pulmonary embolism has superseded other methods of therapy at the Lahey Clinic. In only 10 of the 184 cases was venous ligation carried out as a complementary measure. The indications for venous ligation have been limited to the following conditions: hemorrhage, severe liver disease, ambulatory phlebotrombosis with pulmonary embolism, resistance to anticoagulant therapy of both heparin and dicumarol, recurrence of embolism after adequate therapy and to prophylactic ligation in patients over 60 years of age. Prophylaxis against venous thrombosis consisted of early ambulation and the initiation of dicumarol on the fourth postoperative day.

The following institutional orders are applied to all patients confined in bed. Patients are instructed to exercise the toes and feet one thousand times daily; elastic bandages are applied to the limbs of all patients with varicose veins during their entire stay in bed; daily inspection is made to discover an unexplained fever, pain in the calf, or the presence of a positive Homan's sign; warning signs are plainly stamped on all charts containing the histories of previous venous disease. In patients receiving dicumarol therapy, determinations of the prothrombin time are made daily

in the morning before renewal of the drug in patients receiving both dicumarol and heparin; the coagulation time of the blood is also ascertained; excessive bleeding due to dicumarol is controlled by the intravenous administration of vitamin K—that due to heparin by transfusion of fresh whole blood. Refractoriness was recognized by failure of the prothrombin level to fall below 0.5 per cent of normal during the administration of adequate doses of dicumarol. Heparin in Pitkin's menstruum was given to 55 patients and proved to be a safe and practical method of treatment.

BENJAMIN G. P. SHAFER, M.D.

#### Pulmonary Embolism. RICHARD R. CRUTCHER and R. LEE A. DANIEL, JR., *Am. J. Surg.* 1948, 23, 47

The clinical and autopsy records of patients treated at the Vanderbilt University Hospital, Nashville, Tennessee, over a period of 15 years were analyzed from the standpoint of pulmonary embolism. In that time there were 81,051 admissions, 35,540 operation, 4,182 deaths and 1,550 autopsies. Pulmonary embolism was the causative factor of death in 551 patients, 25 of these had been treated surgically and 40 had had medical treatment. One third of the deaths occurred in individuals under 40 years of age. In the patients who were operated upon emboli occurred within 10 days. The emboli were located in the veins of the lower extremities in 51 per cent of the patients. Patients who succumbed to pulmonary embolism were classified into three groups: (1) those not regarded as seriously ill; (2) those seriously ill with an indeterminable outcome; and (3) those for whom a fatal outcome was expected regardless of pulmonary embolism. The greatest proportion of deaths occurred in the first group and the smallest in the third group.

In some cases clinical signs of phlebitis were masked by edema of the lower extremities and were accounted for on the basis of cardiovascular disease or malnutrition. At autopsy venous thrombi were located either in the extremities or in the lungs. Although 10 patients had shown evidence of attacks of pulmonary infarction, clinical signs of phlebitis were demonstrable in 3. Pulmonary infarcts were found at autopsy in 26 of the 55 patients and of the 16 died of a single embolus. All of the patients in group 1 died of massive embolism involving the large pulmonary arteries. In 40 per cent of the patients thrombi involving pelvic and abdominal veins were located cephalad of the superficial vein.

BENJAMIN G. P. SHAFER, M.D.

#### ANTISEPTIC SURGERY, TREATMENT OF WOUNDS AND INFECTIONS

##### A Study of Burns and Scalds in Children. BEN J. MORRISON, *Arch. Dis. Childh.* 1947, 22, 222

Between June, 1933 and March, 1946, 35 burns and scalds in children were studied. The lesions are classified according to Dupuytren's classification and the author finds a significant relationship be-



tween the degree of the lesion and the constitutional disturbances. It is emphasized that the appearance of any burn or scald within a few hours of the injury is deceptively favorable. It is not until about the tenth day that the area of dead tissue is well defined and then it is often greatly in excess of what at first seemed likely.

During the first few days the clinical features of these injured children were carefully noted and reported. The observations of the blood pressure readings could not be considered reliable except in the quiet cooperative child. The blood examination provided data for estimating fluid lost from the circulation. The red cell counts were unreliable and soon discarded. The hemoglobin seemed reliable when done under uniform conditions but the prevalence of a hypochromic anemia among the children made it difficult to assess the values obtained. The hematocrit value tends to be more constant and gives a quick accurate result in a ward laboratory. Thus the hematocrit proved to be the most valuable single criterion of plasma loss and, in the later cases, was used exclusively for calculations. Values for normal blood and plasma volumes were used with the hematocrit readings for the estimation of plasma loss, as follows:

Case 30—C. R. aged 2 years normal hematocrit for age, 35 per cent. normal blood volume for age, 750 c.c. normal plasma volume for age 490 c.c. abnormal hematocrit ( $2\frac{1}{4}$  hrs. after scalding) 50 per cent. Let abnormal blood volume =  $x$  c.c. then (if total red cell volume,  $R$ , is constant)

$$\frac{35750}{100} = R = \frac{50x}{100} \quad \text{Therefore } x = \frac{35750}{50} = 715 \text{ c.c.}$$

The amount of plasma lost over  $2\frac{1}{4}$  hours, 750—715 = 35 c.c.

$$\frac{35 \times 100}{490} = 7.1 \text{ per cent of total plasma volume}$$

Despite all possible drawbacks of such a calculation as hemolysis or dilution, the treatment based on the formula was more satisfactory than when guided solely by clinical criteria.

The clinical picture may be divided into three successive phases: first fluid loss or concentration of blood second "toxemia" third secondary infection and wasting.

The phase of fluid loss and hemoconcentration was studied in detail. Steady fluid loss persisted for about 24 hours and a smaller loss for a further 12 to 24 hours, but the rate and duration of the loss seemed to vary considerably in different cases, other factors being equal. A composite picture of the usual and fairly constant physical signs and symptoms of progressive reduction in plasma volume and resulting hemoconcentration was obtained and divided into eight stages of fairly constant order of appearance. These are as follows: (1) rising pulse rate (2) thirst (3) coolness of the nose and extremities and mild restlessness (4) pallor, coldness, and cyanosis of the extremities with narrowing pulse commencing drowsiness and vomiting (5) marked restlessness with mental confusion and falling blood pres-

sure (6) air hunger (7) loss of consciousness and (8) complete circulatory failure and death.

Death may occur within an hour of the onset of marked restlessness and mental confusion. In small children convulsions may appear at about stage 5 or 6.

The pulse rate appeared to be of little value in assessing the severity of the injury during the first 48 hours and the rate was affected by plasma reactions, temperature variations and restlessness, as well as by changes in blood concentration.

Cyanosis and pallor and coldness of the skin are indicative of peripheral vasoconstriction, and their appearance and persistence are important. In the author's series their absence did not necessarily mean that all was well but their appearance corresponded to a loss of 30 to 50 per cent of the total plasma volume.

The blood pressure readings were of some help in guiding treatment, but to wait for a marked fall in blood pressure before commencing intravenous therapy is to take unnecessary risks. Hypotension is always a significant, but usually a late, sign. Hypertension was most common and in the majority of cases it appeared only after the administration of plasma had begun.

The mental state followed a very characteristic pattern. During the first few hours after burning the children showed a striking composure: they were alert, quiet, and appeared to have little or no pain. They usually had no complaints but asked repeatedly for drinks. As the picture advanced they often shivered and complained of the cold and asked incessantly for drinks. If they vomited they appeared unconcerned and asked immediately for another drink. At about this stage they tended to become drowsy: they slept lightly and were readily disturbed. Restlessness then appeared and was characterized by sudden movements of the limbs, shouting, and so forth. The spasms passed off as suddenly as they came on and the child was asleep in a few seconds. Drowsiness and mental confusion were noted at this time. Restlessness of this type was a manifestation of reduced plasma volume and striking relief followed efficient intravenous therapy. It is a danger signal and must never be disregarded. Sedatives, notably morphine given at this stage may mask the gravity of the situation. Sedatives are rarely necessary once the fluid loss has been relieved.

Comparison of the hematocrit levels with the clinical findings showed that the hematocrit was a more sensitive index of fluid loss and was considerably raised before clinical illness was obvious. There was a fairly close correlation between severity of the clinical illness and the amount of fluid loss. Stages 1, 2, and 3 corresponded with up to 30 per cent plasma loss. Stages 4 and 5 corresponded with up to 50 to 50 per cent plasma loss. Stage 8 corresponded in one case with 60 per cent plasma loss.

Before stage 4 is reached the signs are not obvious to the inexperienced eye and have always to be looked for. This would indicate that the clinical signs are

a rather late manifestation of a progressive state and that the only safe estimate of the seriousness of the fluid loss is obtained by direct blood examination. Three case histories illustrated these interesting observations.

The phase of toxemia is less well defined and established, and is made up of a group of signs which were related in time and frequency of occurrence. They were first seen toward the end of the first 24 hours and lasted for varying periods of time up to 8 weeks. They did not seem to be attributable to either fluid loss or to secondary infection and their rapid appearance and slow disappearance suggested the action of some toxin. The signs were not observed in all cases.

1 Sustained pyrexia and increased rate of depth of respiration were usually associated. The pyrexia differed from that of a secondary infection by the absence of irregular fluctuations and by its much earlier onset.

2 Hypertension during plasma administration was seen in 23 out of 27 cases in which readings were obtained. Its occurrence was directly associated with the depth of the burn but it was most marked where there was much sloughing.

3 Drowsiness and signs of increased intracranial pressure were present in 6 cases. All of these children had severe, deep burns and showed sustained pyrexia and hypertension.

The onset of cerebral signs with loss of consciousness occurred fairly suddenly between 19 and 33 hours but was preceded by drowsiness. Periods of apparent coma alternated with lucid intervals or restless delirium.

Cerebral edema was usually considered to be the probable explanation of these phenomena. Lumbar punctures were not conclusive however and at the time of onset of the nervous symptoms all of the patients showed a hematocrit value above normal. The duration of the nervous signs was usually only 2 to 3 days. Seven cases illustrating the nervous phenomena are given.

The phase of secondary anemia and wasting was of importance only in lesions covering over 20 per cent of the body surface. In this series bacterial infection appeared about the end of the second or third week.

The wasting was rapidly progressive in the severe cases and tended to become stabilized after 4 or 5 weeks but showed no improvement until healing was well advanced. Some of the wasting can be attributed to aversion to solid food and a reduced caloric intake. Loss of appetite at any time was an omen. It was noted that appetite was often strikingly improved overnight by correction of the anemia with blood transfusion.

Anemia of a progressive character was seen in all severe cases even when obvious secondary infection was not present. The anemia was routinely corrected with blood transfusions. The most noticeable effect of anemia appeared to be a lowering of morale. These patients exhibit a profound emotional upset which

accompanies the physical illness and constant care is required to insure recovery.

Postmortem findings of 7 fatal cases are briefly reviewed.

Treatment of the local wound was delayed until relief and control of the fluid loss had been attained. The local therapy was that of careful cleansing with the gras or vaseline gauze and bandage with special care to bandage in such a manner as to completely seal off the lesion from the exterior. Dressings were repeated at 5 day intervals under general anesthesia. Skin grafting was commenced as soon as clean granulations appeared usually after 6 or 7 weeks.

The avoidance of a certain amount of secondary infection in some cases appears practically impossible. In the treatment of severe wasting the problem of feeding remains a difficult and all important one. To work out a satisfactory high protein diet, however and to persuade the child to take it were two quite separate problems. The interdependence of appetite morale anemia and secondary infection is very complex and of great importance.

As regards the treatment in the phase of fluid loss and concentration of the blood, it is essential that there be early recognition of the developing hemoconcentration. As more experience was obtained more reliance was placed on the hematocrit and the intravenous fluid was given with the aim of obtaining a definite value for this. In the majority of cases the actual and expected results for the amount of fluid given showed good correlation when based on the formula used. Saline solutions were found to be of little or no use in the relief of marked plasma loss but may need to be given in addition to plasma in cases in which the urine output is low and the child is unable to drink.

HARVEY S. ALLEN, M.D.

**Hard Dorsal Post Traumatic Edema of the Hand**  
CLARENCE A. LUCKEY and HENRY D. MOON, *Plast Reconstr Surg* 1947 2: 563.

Hard dorsal post traumatic edema of the hand has been observed for many years however pathological studies have rarely been carried out. Unless one is familiar with the affliction the true nature may not be suspected and proper treatment may not be carried out. The rarity of the condition undoubtedly accounts for the lack of clinical recognition in some instances.

As the name implies, the edema usually comes on following trauma and is localized to the dorsum of the hand. There is no pitting, the swelling is hard and it does not extend to the fingers or to the wrist. Early in the century individuals afflicted with this disability were suspected of malingering however since that time the organic basis has been recognized.

According to Iselin hard dorsal edema was first described by Secretan in 1901. Iselin states he personally has never seen a case. Tinel and Moncay believe that a circulatory obstruction is present. They believe that there is vasoconstriction of the capillary and venous system and that transudation

occurs from the arterioles. Andre Thomas and Kudelski suggested that the edema may be due to an inflammatory process involving the lymphatics, venous system, and other tissues.

The authors are reporting on 2 cases of hard dorsal post traumatic edema of the hand incurred in the army and treated by excision of the mass.

The first patient, a white male was struck on the dorsum of the right hand by the recoil of a .75 mm. gun in March, 1914. A hematoma developed on the dorsum of the hand following the injury. This was removed a short time following injury. Hard dorsal swelling of the hand ensued and motion became quite limited in spite of extensive activity of the hand. In addition the patient had pain in the hand. X-ray therapy was given but no benefit noted. Since conservative therapy did not bring about any improvement in the condition excision of the mass was decided upon.

The cause of the hard dorsal post traumatic edema remains somewhat obscure. The macrophages containing hemosiderin suggest that the fibrous tissue formation may be secondary to hematoma formation in some cases. This is consistent with the clinical history in each of the authors' cases. There is an individual predilection to keloid formation. The mass removed is not unlike keloid material. This individual variation to scar formation may explain to a point at least why this process takes place in some injured hands and not in others. The microscopic sections show that the scar tissue is quite mature.

On the basis of this finding and also since reasonably good results follow surgical excision the authors believe that complete excision of the fibrous tissue mass is the treatment of choice. Skin grafting following excision of the mass may be of benefit. Since the fibrous tissue is mature spontaneous regression is not likely.

LOUIS T. BIVARS, M.D.

#### Pi. *Stic Repair of the Extremities by Nontubulated Pedicle Skin Flaps.* JOHN MARQUIS COVATTA, *J Bone Surg* 1918 30-A 63

The following observations are based on 781 operations for repair of surface defects of the extremities by nontubulated pedicle skin flaps. The pedicle flap because of its make-up of epidermis, dermis and subcutaneous fat, provides not only a skin dressing but adds elasticity and extensibility to joint surfaces, which allows for the normal stress and strain of everyday trauma.

Pedicle flap grafts are especially indicated in the following conditions: (1) to cover a surface defect over an area of active function such as the joints of the elbow or knee; (2) to provide a vascular integument over bone so as to allow for secondary operations such as bone graft or joint resection; inhibiting ischemic necrosis, osteomyelitis and sequestration; (3) for tendon repair to supply an inner adipose surface to keep tendons free from adhesions and provide sliding pathways for their action; (4) as a cover in the repair of peripheral nerves to minimize scar

formation with its concomitant effect on conductivity and pain.

Local or contiguous flaps are obtained from the vicinity of the primary defect, and are of two types: the transposed flap and the rotation flap, the latter comprising the swinging rotation and the advancement rotation types. Local flaps are applicable for the upper extremity and the ankle or foot, but are necessarily limited by the size of the defect and the character of the tissue. Distant flaps are called direct when they are immediately transferred to the recipient site and are indirect when migration is necessary before reaching the donor site. In cases in which viability is in doubt flaps are best delayed. Delayed flaps may usually be transferred after from 10 to 14 days. In the present series, 8 of 370 distant flaps were delayed. The mapping of a true defect of any extremity is best accomplished by outlining the defect on the unaffected limb and using fixed bony points for locating longitudinal and horizontal boundaries of the defect. A true defect should be distinguished from an apparent defect which is modified by scarring and contractures.

The following points should be observed in the planning of the flap: (1) the flap operation should cause little discomfort to favor complete immobilization; (2) the transfer should be as rapid as possible and (3) the flap should be derived from a suitable donor area. The design of the flap should be prepared in such a manner as to leave an optimum angle for its attachment and maintenance of its blood supply without kinking of blood vessels. The length of the flap should not be greater than one and a half times the width. Flap operations should be temporarily delayed during the period of redness and edema of wound margins, elevation of temperature, profuse discharge, or the identification of a hemolytic streptococcus present on wound culture.

For effective flap transfer, hemostasis and careful suture of the skin edges are necessary for primary union. The raw area of the donor site may be closed by a split thickness graft or sutured without tension when possible, by undermining of the tissue. The use of a hinge flap is a valuable method of eliminating the raw area under the main flap. Flaps are generally separated on the fourteenth day, but in the covering of denuded bone, 21 days are allowed before separation. Defects of the fingers, the interdigital spaces and the palm of the hand are repaired by cross arm flaps. Abdominal flaps are used to repair defects of the dorsum of the hand and forearm. The elbow region is best covered by a flap raised just above the iliac crest. Defects of the arm are covered by thoracobrachial flaps. Cross leg flaps are used to cover denuded bones of the leg or foot, the position of the transfer depending on the location of the site of the defect. The inner half of the sole of the foot is covered by an oblique flap raised from the posteromedial aspect of the opposite leg. Failures in flap transfers are due to necrosis, infection, or improper postoperative care.

BENJAMIN G. P. SHATTUCK, M.D.

## ANESTHESIA

**Anesthesia with Intravenous Pentothal Sodium and Local Nerve Block in Gynecologic Surgery**  
 JAMES C. McCANN *N. England J. M., 1947 337*  
 931

Intravenous drop of pentothal sodium in a 1 per cent solution combined with local nerve block with 1 per cent procaine was given in 60 to 70 per cent of 2,000 general surgical procedures, and quantitative and pneumographic observations were made. In general it was found that the rate of administration of pentothal sodium was related to the need for the drug in the particular case as determined by the rate of metabolic destruction of the drug and duration of operation and its type depending on the neurologic segment in the peripheral area of distribution of the nerves in which the operation occurs. There was no evidence to indicate any so-called cumulative action of the drug for with reflex factors well controlled by procaine field block, there seems to be ample evidence of fixed level basic needs for the drug in each patient, even over an extended period. During the induction, pentothal was infused at the rate of 350 drops a minute until unconsciousness occurred. No further administration of the drug was made until the irregularities of respiration returned to normal then quantities of 10 c.c. every minute in patients under 50 years of age or 5 c.c. in thin small patients over 50 years of age were given. This was repeated from 2 to 4 times until surgical anesthesia was reached. Subsequent maintenance was obtained by the administration of pentothal at the rate of 130 drops per minute whenever recurring reflex stimulation of respiration by surgical trauma manifested itself.

In vaginal operative work a method of continuous administration of pentothal and ether was used in which, after the usual induction of pentothal in 1 per cent solution the drug was administered continuously in a 0.5 per cent solution at the rate of 30 drops a minute. Ether was administered continuously at the rate of 28 gm. an hour. Two gm. were considered the limit of pentothal after which ether alone was given to complete the operation.

The technique of transincisional procaine block of the intercostal nerves to the lower half of the rectus muscle is described. It was carried out after complete incision of the skin subcutaneous tissues and fascial anterior layer of the rectus sheath occurred. With this method 87 per cent of the male patients failed to exhibit adequate abdominal relaxation 72 per cent of the females who had a preceding pregnancy had adequate relaxation. Subsequent use of cyclopropane ether or curare with pentothal controlled the more powerful intra-abdominal reflexes. There was a reduction of 50 per cent in the need for pentothal as a result of peripheral blockage of all pain impulses by procaine field block, in a series of hysterectomies studied. There was an over all mortality for the entire group of .04 of 1 per cent and for major gynecological procedures .07 of 1 per cent.

Pneumographic tracings demonstrate the characteristic patterns of reflex response of respiration to trauma in the three neurological fields involved by surgical trauma during pelvic surgery  
 MARY KARP M.D.

**Pentobarbital Sodium-Curare Induction for Endotracheal Intubation** H. CARROW V. K. STOKELY  
 DMO and S. C. CULLEN *Anesthesiology 1948 9 11*

Curare had been used in conjunction with nitrous oxide and with pentothal to provide anesthesia and relaxation for intubation with the tracheal tube. Results of these combinations were unsatisfactory in the authors' experience.

Reported observations of a synergistic hypnotic action of pentobarbital sodium and curare suggested the use of these agents prior to intubation.

The technique used was as follows:

Preliminary medication of morphine and scopolamine was administered. Intravenous fluids were started and a 5 to 6 per cent solution of pentobarbital sodium was administered through the infusion until the patient lost the lid reflex and did not respond to questioning. Dosage ranged from 98 to 293 mgm. with an average of 211 mgm. Oxygen was administered with a bag and mask and fractional doses of curare were given to provide relaxation of the jaw. The average dose of curare was 107 units, the dose varying from 50 to 200 units.

Intubation did not prove difficult when this procedure was followed.

A summary of cases in which this pentothal sodium-curare technique has been used is presented.

Advantages of this technique are rapid induction of anesthesia, a lack or minimal degree of laryngospasm, ease of intubation and rapid recovery from anesthesia  
 MARY KARP M.D.

**Glycogenolysis under Prolonged Use of Sodium Seconal and Sodium Phenobarbital in Dogs**  
 NORMAN A. DAVID, NILKANTH M. PHATAK, ROSA KURTIN and HERMAN F. VEHRA. *Current Res. Anesth.* 1948 27 25

When barbiturates are used as preanesthetic agents the hyperglycemia caused by such anesthetics as ether which act principally on the cerebral cortex is reduced. In 6 dogs which were treated for a period of several months with daily minimal anesthetic doses of sodium seconal, glucose tolerance tests performed during a 40 hour abstinence period showed a normal type of dextrose clearance curve. A second tolerance test performed on these dogs after a 20 or 21 day barbiturate withdrawal period, showed a definite trend toward increased tolerance. The livers of these animals at autopsy were normal on gross and microscopic examination.

The mechanism of this increased carbohydrate tolerance in dogs under prolonged barbiturate treatment is neither explained nor established. This effect may be due to some changes in the endocrine balance which are normally effective in the blood glucose regulating function of the liver or to a direct

metabolic protection of the detoxifying organ by preventing its glycogenolysis. These possibilities need further experimental exploration which is now in progress.

MARY FRANCES POE M.D.

# Endotracheal Anesthesia for Operations on Cleft Lip and Cleft Palate. M. D. LEIGH and H. A. KESTER. *Anesthesiology* 9:139-142

Some modifications of the usual endotracheal technique are used by the authors in anesthesia on children of less than a year old. Beyond that age the technique is not materially different from that in common use (Adrian child circle filter technique).

Premedication is somewhat unusual in that morphine and scopolamine are used in patients of any age. This has been the practice of the authors in more than half of their series of cases, for a period of 7 years. However, no dosage table is included.

Induction of anesthesia is accomplished with diethyl ether followed by diethyl ether both given by open drop. Very early use of an oral oropharyngeal airway is advocated to prevent obstruction by the tongue falling into the cleft in the palate.

Intubation is done in the second plane of stage 3 care being taken to flood the lungs with oxygen under the mask just before intubation. The patient's head is levated in a padded ring which enhances stability of the head and flexes the neck on the shoulders. The authors use their own modification of the laryngoscope with a wide blade narrowed anteroposterior diameter and a bend upward of the blade at its tip. The width of the blade aids in preventing the end of the instrument from dropping into the cleft in the palate.

A soft rubber or vinyl plastic Magill tube lubricated with water soluble nupercaine jelly is used

Abduction of adducted cords may be obtained by blowing down a tube whose tip is placed at the root of the tongue. The pharynx is then sucked off. The authors offer comparisons and recommendations on the sizes and lengths of tubes used. Oral endotracheal tubes are long enough to reach from the lobe of the ear to the tip of the nose with 1 to 2 cm. to spare. No cuff is used on the tube as the cords soon accommodate to the tube and no anesthetic mixture is lost.

Maintenance is accomplished with an apparatus consisting of an endotracheal tube, a metal connector with a bore the same size as the tube, a short piece of rubber tubing, the metal piece containing the inhalation and exhalation valve (Leigh valve), a 2 liter reservoir bag and a rubber tube leading to the gas feed. Nitrous oxide and oxygen are supplied if necessary ether or cyclopropane is added for depth. The technique described was used in 34 per cent of the cases and Ayer's technique was used in 66 per cent.

Blood loss is replaced as it occurs, through a venous cut-down. Complications in induction are those of any open drop anesthetic. Endobronchial intubation is the most serious maintenance complication and accounted for one death. If rapid, deep respirations threaten to lead to collapse of the patient, double the premedication dose of morphine is given intravenously. Postoperative complications center about maintenance of the airway in an infant previously accustomed to more airway space than he now has.

Of the 493 patients whose cases are reported, 57 per cent were 5 years of age or under. Three deaths occurred: one from bronchial intubation, one from shock and one from transfusion of incompatible blood.

MARY KARR M.D.

# PHYSICO-CHEMICAL METHODS IN SURGERY

## ROENTGENOLOGY

**The Association of Achalasia of the Cardia with Esophageal Carcinoma** P. BAER and K. SICHER  
*Brit. J. Radiol.* 1947 20 528.

The association of carcinoma of the esophagus with cardiospasm or achalasia is not well recognized. The authors have found in the literature 8 such cases in which the clinical data were adequately included and 9 cases in which the clinical details were not available because of the wartime disposal of medical libraries. To these they added one case.

All of the tumors were located in the midesophagus (dilated portion) and nearly all were squamous cell carcinomas. The average age was 54.9 years and 80 per cent of the patients were males. The average lapse of time from the onset of achalasia until the carcinoma was identified was 19.3 years, and the symptom free interval after treatment of the achalasia was 7 years.

Because the tumor develops in the dilated esophagus marked obstructive symptoms do not appear even though the tumor may be quite large.

Roentgen diagnosis is difficult not only because the elongated tortuous esophagus may be filled with food but the demonstration of achalasia may be taken as an adequate explanation of the symptoms of the patient and the carcinoma may be overlooked. Loss of weight which is out of proportion to the duration of the symptoms of achalasia and the presence of blood tinged vomitus however are signs which are very suggestive of carcinoma.

The authors believe that achalasia produces conditions which are favorable to the development of carcinoma.

ROBERT BURNS LEWIS, M.D.

**Special Roentgenographic Aspect that May Be Assumed by Primary Carcinoma of the First Part of the Duodenum** (Sul particolare aspetto radiologico che possono assumere i canceri primitivi della prima porzione duodenale) DOMENICO BEDETTI.  
*Arch. ital. mal. app. diger.* 1947 13 353.

A short discussion of the difficulty in diagnosing malignancy of the duodenum is followed by the report of a case in which the diagnosis of carcinoma of the first part of the duodenum was made roentgenologically before operation and confirmed by surgical intervention. This is of great interest because (1) the precise location of the tumor was determined and (2) the neoplasm was diagnosed as a primary one in the first part of the duodenum.

The case could have been easily diagnosed as a primary tumor of a contiguous organ, a polyp of the stomach or duodenum, or as a gastroduodenal invagination but the increase in size and the rigidity of the duodenal bulb with its filiform channeling conveyed the idea that the tumor was primary in this part of the intestinal tract.

Cancer of the duodenum, because of the annular arrangement of the submucous lymphatics assumes a circular pattern. Viewed from within the lumen the neoplasm appears like a rigid valve ulcerated at times. When the tumor is located near the genu superior of the duodenum it will cause an enlargement of the bulbous portion which at times may approach a gigantic size. When the neoplasm is located near the pylorus the stomach is the part to become dilated the duodenal bulb appearing like a rigid canal.

The polypoid type has a tendency to ulcerate. There is however a malignant ulcerative type annular in shape which involves from one half to three fourths of the circumference of the viscus. It has a hard base the edges are raised and the growth bleeds easily. The serosal aspect of the bulb may appear normal or the bulb may be impregnated with cicatricial tissue when the ulcer is small. This type has been diagnosed as an ulcer by both the radiologist and the operating surgeon.

The roentgenographic findings are

- 1 In the annular type there is a more or less serrated stenosis. When the growth is juxtapyloric there will be pyloric stenosis and when involving the genu superior of the duodenum the bulb will be markedly dilated and later will involve the pylorus and stomach. The diagnosis in these cases is difficult. A partial stenosis changes the duodenal bulb to an irregular small somewhat tortuous channel.

- 2 In the ulcerative type the diagnosis is difficult the x ray findings being very similar to those of a benign duodenal ulcer.

- 3 The vegetative type shows a gigantic bulb with an irregular filling defect and numerous intersecting lines of an irregular pattern. A niche, proof of its tendency to ulcerate may be seen at times.

Dilatation of the bulb may be caused also by sarcomas. According to Stammer these may be

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- 2 Intramural sarcomas circumscribed or diffused and unless very extensive may be very difficult to diagnose.

The sarcomas are lymphosarcomas.

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**Study of the Gall Bladder in Obstructive Jaundice by Means of Diagnostic Pneumoperitoneum** (Studio delle colecisti negli itteri da occlusione mediante pneumoperitoneo diagnostico) ANTONIO LURA and AXILE VIVARELLI. *Radiol. med.*, Milano 1947 33 633.

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Cholecystography is either contraindicated in obstructive jaundice or fails to furnish sufficient



information. In such instances pneumoperitoneum renders good services because it allows the study of the location, size morphologic aspect of the gall bladder and demonstrates its relations to the adjoining organs. With the application of Courvoisier's law an occlusion of the gall bladder by a calculus can be differentiated from a malignancy.

The study can be done with the patient in one of the following 3 positions (1) upright, (2) supine, with roentgenograms taken in the postero-anterior direction and (3) recumbent position, with roentgenograms taken in lateral direction. Modifications of the position can be advantageously employed according to individual requirements.

A gall bladder nearly completely hidden under the liver cannot be easily differentiated from Riedel's lobe. Excessive weight of the patient or close apposition of the liver to the right kidney duodenum or the transverse colon may also interfere with the visualization of the gall bladder.

The author recommends the following positions:

1. Reverse Trendelenburg—roentgenograms to be taken in the dorsoventral direction. The degree of the optimal inclination of the table should be determined by means of a fluoroscopic examination. The patient lies on the table in supine position.

2. Left semilateral prone position—the x-rays to be directed from the right flank toward the front. This technique is especially recommended for cases in which the gall bladder is adherent to the parietal peritoneum. Pneumoperitoneum may be supplemented in selected cases by the administration of barium per os.

In 35 cases the pneumoperitoneum rendered valuable services in regard to the diagnosis.

JOSSEPH K. NARAY, M.D.

Intracranial Angiography via the Vertebral Artery  
STIG RADDER. *Acta radiol. Stockh.*, 1947 28, 838.

The author describes a technique which may be used for vertebral angiography. A ureteral catheter is introduced via the radial artery. The radial artery is exposed and ligated distally in the wound, and a tourniquet is applied proximally. A small cut is then made in the vessel and the catheter is inserted. The tourniquet is removed and the catheter is gradually introduced under fluoroscopic guidance. When the catheter has entered the vertebral artery 10 c.c. of 35 per cent diodrast solution are injected and suitable roentgenograms are taken.

Following removal of the catheter the radial artery is ligated. No palpable difference has been noted in the radial pulse at the wrist after ligation.

Thus far the method has been used in only a few cases.

C. R. PERRYMAN, M.D.

Roentgen Therapy in Melanoblastoma (La pleuro-roentgentherapie del melanoblastoma). FRANCESCO SANTAGATI. *Radiol. med.*, Milano, 1947 33, 337.

Thirty-eight cases of melanoma treated in the Radiology Institute of Milan were received and classified according to the method of therapy.

The first group consisted of 24 patients treated by roentgen therapy alone of these, 9 were cured for time intervals varying from 1 to 5 years, 2 were not followed up and 3 showed evidence of metastases in 1 to 3 years.

The second group consisted of 3 patients who were treated surgically. In this group evidence of recurrence at the site of operation necessitated subsequent irradiation which resulted in cure in the 2 subjects in whom metastases had not developed, at an interval of 6 years.

The third group included 7 patients treated with radium only. Although the lesions in this group were on the whole, somewhat more advanced, only 1 instance of metastases was noted. Of these, 4 were cured for time intervals varying from 24 months to more than 3 years.

In the fourth group were 14 patients treated by surgery with subsequent application of radium. Of this series 4 showed metastases. Of the 14, 6 were well at 3 years or less, while the others showed recurrence or were lost to the clinic.

The results obtained in these cases suggest that irradiation can be successfully employed in the treatment of these tumors, and that surgery should be used only when irradiation is impracticable.

EDITH B. FARBEROWITZ, M.D.

## RADIUM

The Treatment of Cavernous Hemangiomas in Young Infants (Le traitement des angiomes tubéreux des jeunes enfants). SIMONE LABORDE. *Acta radiol. Stockh.*, 1947 28, 73.

The author reports the results of radiation therapy in 315 young infants and children with cavernous hemangioma. Both large and small hemangiomas and portwine birthmarks were treated. The report is one of impressions rather than of statistics.

Laborde believes that the treatment may be initiated in early infancy having started it in infants at the age of a few months. His patients were treated by radiation alone. All forms of irradiation were employed but in general he preferred the use of either the radium element or radium emanation. In some instances removable radium seeds were employed. These were especially useful in the large cavernous types of hemangioma. The author preferred the use of minimal doses, either in flat enamel containers or needles containing 1 or 2 mgr. of radium with 0.5 mm. of platinum filtration. The beta rays are the most important.

The use of very small doses avoids most of the complications, such as actinic ulceration disturbances of growth at the epiphyseal lines, or depressions of the flat bones even epilation was avoided. These doses may be repeated at intervals of 3 to 4 months. It is often noted that the lesion will regress for quite a few months, and it may take even years to disappear completely.

In this series no other methods of therapy were employed. The results have been eminently satis-

factory from both a therapeutic and cosmetic standpoint. Except for the ulcerated angiomata which always leave a scar esthetic results have been the rule rather than the exception. The illustrations confirm these opinions. WILLIAM C. BECK, M.D.

**Some Complicating Factors in the Radium Treatment of Carcinoma of the Cervix Uteri.** GILBERT I. STRACHAN *Acta radiol.*, Stockh. 1947 28 545

There are five conditions which are the main contraindications to the insertion of radium in the treatment of carcinoma of the cervix. These are: (1) advanced emaciation and cachexia, (2) extensive anemia, (3) inflammatory pelvic lesions, (4) an extreme degree of pelvic extension, and (5) fistula formation. The anemia and inflammatory pelvic lesions are temporary but should be corrected before the radium is inserted. The red blood count should not be below 3 million cells and the hemoglobin not below 40 per cent. This can be corrected by bed rest, nourishment, and blood transfusions. The present-day use of penicillin has been very effective in the treatment of inflammatory pelvic lesions. These include parametritis, peritonitis, pyometria, salpingitis, pyosalpinx, and pelvic abscess. Pyometria is particularly deceptive and difficult to diagnose. It should be cleared up before the radium is inserted. Occasionally the emaciation and the cachexia can be improved but if it is not, the insertion of the radium may hasten the fatal results. The author believes that an occasional case of rectovaginal fistula can be benefited by means of radium treatment, but that vesicovaginal fistulas are aggravated by it.

The cervical canal may sometimes be very difficult to find and may very often be toward the periphery of the mass. Great care must be used in probing for this canal as trauma to this region is a very important cause of pelvic inflammatory disease. Postoperative complications are relatively rare but are often associated with poor or faulty technique. Most frequently they are observed as irritant effects to the adjacent bladder, rectum, or vagina. Packing the bladder and rectum out of the field with gauze will reduce the incidence of these complications markedly. Other important postoperative complications include pelvic infection, postoperative pyometria, fistulas (rectovaginal, vesicovaginal, or both), intestinal obstruction, and rectal and urethral stricture formations. Pyometria is most common in patients over 50 years of age. Pelvic infection was frequently associated with considerable probing to find the uterine os. The majority of the fistulas occurred in stage 3 cases. The primary mortality from the insertion of the radium was 2.6 per cent in the author's series of cases at Cardiff Royal Infirmary, England.

To evaluate the risk to the patient and to determine the presence of contraindicating factors particularly those which are amenable to treatment it is necessary to do a thorough examination of the patient, and this should be done by experienced and well-trained specialists. S. A. PATTERSON, M.D.

**The Results of the Treatment of Carcinoma of the Uterine Cervix in the Radiologic Institute of Helsinki in the Years from 1937 to 1942** (Ueber die Behandlungsergebnisse der Kollumkarzinome im Strahlenbehandlungsinstitut zu Helsinki aus den Jahren 1937-42). V. KAHANPÄÄ and J. O. KANKKUNEN *Acta radiol.* Stockh. 1947 28 519

The authors review the results in 524 patients with carcinoma of the cervix treated by radiation alone for over a 5 year period. Only 35 per cent of these were considered to be in a favorable stage for this type of therapy. Many patients with early conditions were subjected to operative therapy, and many patients were sent to the institute for palliative therapy because nothing else could be done for them. The former are not included in this report. The series is also not a perfect one as it was collected during the war years and some of the therapy had to be hurried or stopped because of the exigencies of war. For a time the clinic had to be completely cleared to permit repair of bomb damage.

Nevertheless, the average time of the appearance of the patient in the clinic from the time of the first abnormal bleeding was 6.2 months. The time lag between the patient's first consultation with a physician and her appearance for therapy was 1.3 months. The author blames the late visit of the patient to her physician on the indolence of the patient and her disrespect for the obvious symptoms. In 58 patients of this series (11.1%) the condition was completely hopeless and not treated either because of the extent of the growth, the poor condition presented by the patient, or the presence of distant metastases.

The therapy usually consisted of radium so placed as to irradiate both the uterine cervix and the vagina. In patients in whom the vagina was roomy and the rectum could be packed well out of the way the vaginal doses were greatest. In some cases a lead plate was employed to protect the rectum. The average treatment consisted of 3,300 millicuries to the uterus and 4,700 millicuries to the vagina. A total irradiation dose of 8,000 millicuries was given. This was followed immediately by roentgen ray irradiation of the parametrium with 2,400 roentgen units as the depth dose. This was applied through two anterior and two posterolateral portals. The radiation was stopped if there was a marked rise in fever. The complication of a moderate proctitis with diarrhea and some blood was frequent, but rectovaginal fistula was rare.

All of the cases were studied histologically. Of the 466 patients, 167, or 35.8 per cent, were alive at the end of 5 years. The percentage of 5 year cures was in direct relationship to the clinical stage of the carcinoma: that is, 88 per cent of those with carcinoma classed as grade 1 were alive at that time, while only 6 per cent of those with carcinoma classed as grade 4 were alive. On the other hand, there did not appear to be any relationship between the histological classification and the percentage of cures.

WILLIAM C. BECK, M.D.

The Experiences with Radiotherapy in Cancer of the Cervix and of the Corpus of the Uterus at the Radium Center in Odense. P. JACOVY. *Acta radiol. Stockh.*, 947 28 505.

The results of radiological treatment of cancer of the cervix and cancer of the body of the uterus at Radium Center in Odense, from 1938 to 1941, are presented and analyzed. The results obtained are grouped according to the League of Nations criteria. Three hundred and seventy three patients with cancer of the cervix were examined and 365 patients received treatment. Of these, 120 patients were free from evidence of the disease after a period of 5 years with an absolute cure rate of 33.2 per cent and a relative cure rate of 39 per cent. All of the patients received external roentgen therapy in addition to the radium treatment.

Since 1938 the procedure has been to complete roentgen therapy before radium is applied and it is the author's opinion that this manner of treatment has proved to be a very valuable refinement of the technique. At the same time the responsibility for the roentgen treatment was shifted from the surgeon to the radiologist. As a result of one or both of these factors the percentage of 5 year cures was considerably greater after 1938 particularly of lesions in stages 3 and 4. The primary mortality in the total series was 11 per cent. In 11 per cent of the cases, bladder and rectal reactions such as fistula, were

encountered in from 1 to 5 years following treatment, but in only 11 per cent of the cases were these of a permanent nature. The intensity of radium treatment was 6,000 to 7,000 mgm. hr. The average dose to the parametrium from external therapy averaged between 2,000 and 2,500 roentgens.

Cancer of the body of the uterus was divided into three categories according to Heyman's grouping, viz. (1) clinically operable lesions (2) technically operable lesions, but had risks because of other reasons such as obesity of the patient, old age or associated disease and (3) inoperable lesions. It is noted that all cases of carcinoma of the cervix, in Denmark are referred to radiological treatment, but that there is no definite policy concerning treatment of cancer of the body of the uterus. Some patients are treated surgically (if the lesion is in the operable category) while others are treated radiologically. Before 1940 the radiological treatment of cancer of the body of the uterus was nearly the same as that for carcinoma of the cervix but since 1940 the packing treatment of Heyman has been used. The results obtained with the later treatment were definitely superior. The author notes that treatment of the operable lesions with radium gave equally as good results as treatment by surgery. The results of radiological treatment were much better in the clinically operable group than in the other two groups.

S. A. PATTERSON M.D.

## MISCELLANEOUS

### CLINICAL ENTITIES—GENERAL PHYSIOLOGICAL CONDITIONS

**Diagnosis of the Thrombopenic Purpura. Study of the Megakaryocytes of the Sternal Marrow Thrombopenias of the Menopause** (Diagnostic des purpuras thrombopéniques. Étude des mégakaryocytes de la moelle sternale: thrombopénies de la ménopause) BERNARD DREYFUS and J. P. SOULIER. *Rev hemat* 1947 2 303

It is often difficult to distinguish between the idiopathic thrombopenias and those secondary to the action of chemical or physical agents. Etiologic, clinical and hematologic data allow differentiating them, but not always and the myelogram should be of great help.

The normal megakaryocyte rate and the physiologic equilibrium of young adult degenerated and platelet forming megakaryocytes are variably given by different investigators. Therefore, the authors have first studied eight normal myelograms. The rates ranged from 150 to 600 megakaryocytes per million nucleated cells. There was a certain parallelism between the megakaryocyte rate and the percentage of young and platelet forming varieties of megakaryocytes. A normal slide may not contain megakaryocytes with platelets.

The megakaryocyte series presents remarkable peculiarities in idiopathic thrombopenia of which 9 cases are considered at least 5 cases were genodystrophic purpura. Megakaryocyte hyperplasia is the rule the normal number of these cells is increased three, five, and sometimes tenfold so that in some cases the diagnosis is suggested as soon as a slide is examined under low magnification. The absence of megakaryocytes with platelet formation is no less remarkable. A high percentage of young forms is usual but is not surprising in megakaryocytic hyperplasia. The number of degenerated megakaryocytes seems to be below normal. There is usually an asynchronism between a completed nuclear maturation and a young intensely basophil cytoplasm.

The myelogram of secondary thrombopenia of which eight slides have been studied may present three types. The first two types cannot be confused with the picture of primary thrombopenia, whether there is a hypoplasia or aplasia with rarefaction or even disappearance of the megakaryocytes or the appearance is that of a normal slide. The third type is rather deceptive because of the normal number of megakaryocytes and the absence of megakaryocytes with platelet formation. However the paradoxical hyperplasia so characteristic of primary thrombopenia is usually absent. The determination of the percentage of young and degenerated forms is of little usefulness. The finding of intense megakaryocyte macrophagy is perhaps a sign of infectious purpura. Decidedly evolutive changes militate in favor of secondary thrombopenia.

The data of the myelogram alone allow a classification of the thrombopenias into those of myeloid origin (those due to a defect of elaboration and those due to a disturbance of the megakaryocyte maturation) and those of peripheral type, due to capillary accumulation or excessive splenic destruction but without myeloid lesion. The medullary localization of the disturbance in the formation of platelets does not exclude a splenic causation.

The clinical facts suggest the possibility of dividing the idiopathic thrombopenias into the constitutional (diathetic and genodystrophic, the latter being subject to splenectomy) and the acquired, which include a rather peculiar type—the thrombopenias of the menopause, which are represented by 2 observations.

RICHARD KEMEL, M.D.

**The Surgical Treatment of Pressure Sores, STUART GORDON** *Plast Reconstr Surg*, 1947 2 557

Efforts directed at making the paraplegic patient ambulant have brought the problem of the treatment of pressure sores to the fore. While the removal of pressure together with good nursing will usually result in healing, the time taken is long and when the sores are healed the covering is unstable. A few free grafts were tried but their use was quickly abandoned. This led to the consideration of pedicle grafting. It soon became obvious that the best type of pedicle graft was a large local rotation flap so planned that there was a minimum of scar over the pressure points.

Patients selected for operation are those in whom invasive infection is absent whose blood urea is within normal limits whose hemoglobin level is satisfactory whose appetite is good and whose serum protein level is normal. Occasionally closure of a pressure sore must be done when conditions are not ideal. Thus, the actual blood protein level may be abnormally low the patient steadily losing ground. In such a case successful closure of the pressure sore will abruptly stop the constant loss of protein and will in fact, be a life-saving measure.

At first the author attempted to operate on paraplegic patients without anesthesia but the patients developed pallor sweating nausea, vomiting low erred blood pressure and a fast pulse. The authors have now made it a routine practice to give these patients a general anesthetic.

Fifty operations have been done on 27 patients. A large rotation flap was used to cover the raw area left after excision of the pressure sore in 46 instances a VY advancement in one a Z plastic shift in 2 patients and multiple local flaps in 1 patient. Primary healing was obtained in 31 instances slight separation in 13 and marked separation in 6. Even though satisfactory healing occurred in 48 patients free grafts to close the donor sites of flaps are rarely needed.

LOUIS T. BYARS, M.D.

**A Case of Glomus Tumor with Primary Involvement of Bone** RAFAEL LATTES and DAVID C. BULL. *Ann Surg* 1948, 127: 87

The authors report a case of glomus tumor because of its unusual location. The patient was a 28 year old white woman whose chief complaint was pain in the right thumb of 4 years duration. The thumb was enlarged with thickened and discolored skin and vesicles on the volar surface. Roentgenograms showed honeycombed areas of decalcification in the distal phalanx. At operation the terminal phalanx of the thumb was found to be almost completely replaced by areas of softening containing a jellylike material. The lesion was curetted, the defect filled with a bone graft, and the patient had no further symptoms. Microscopic examination revealed typical histological features of a glomus tumor with spindle shaped glomus cells, epithelioid elements, and smooth muscle cells.

The writers believe this is only the second case report of a glomus tumor completely encased in bone. However many cases have been reported of glomus tumors which occurred in places other than the cutaneous-subcutaneous junction where normal glomera are usually found. These cases can be explained by assuming the existence of normal glomera sparsely distributed anywhere in the body or by considering the glomus tumor a highly differentiated and specialized variety of hemangiopericytoma. It is probable that both the glomus cell and the pericyte represent modified smooth muscle elements from blood vessel walls and that both descend from a common undifferentiated stem cell. It is conceivable that a neoplasm arising from such a stem cell might differentiate into a glomus tumor even in a region where glomera are not normally found.

S. LLOYD TRITTMAN, M.D.

**The Changing Cancer Death Rates.** EVELYN A. POTTER. *Cancer Res* 1947 7: 35

In epidemiological studies of cancer consideration of both tumor origin and pathologic histology is essential to avoid the fallacies inherent in mixed classifications. At present however the cellular variations are not listed in the vital statistics reports. To secure a correct picture of changes in mortality an adjustment of crude death rates is necessary because of the effect of a changing age composition in the population.

This presentation concerns itself with studying cancer data by the site of origin. The adjusted rate for each of the 22 sites studied was allocated to one of three classes depending on whether the adjusted rate showed an upward trend, a downward trend, or no significant trend.

The class showing upward trends included cancers of the pancreas, testes, prostate, intestines, lung, pharynx, larynx (male), other respiratory organs, ovary, rectum (male), and kidney (male). This was considered, at least in part to be due to a higher accuracy in diagnosis. Cancers of the lungs, other respiratory organs, and pharynx revealed the great

est increase possibly as a result also of an increase of respiratory irritating agents.

In the class exhibiting no significant trend were cancers of the larynx (female), vulva, vagina, breast, scrotum, bladder, esophagus, kidney (female), and rectum (female). The adjusted rates for most of these sites were small, the principal exception being cancer of the breast (female). The latter however doubtlessly belongs with the sites having declining rates since many cases, which had metastasized, were formerly mistaken for and classified as primary cancer of the liver, a disease which is found to have decreased.

Cancers of the stomach, buccal cavity, skin, uterus, and liver showed an appreciable downward trend. Education and improved therapy probably played leading roles in this reduction. Better obstetrical care and the declining birth rate were also considered to be significant factors in cancer of the uterus. The relationship between childbearing and cancer of the uterus has been well established.

However the decrease that has occurred in the mortality from gastric cancer is far greater than could be expected to result from the general educational programs and from improved medical service. The author speculates that this improvement is probably due to better dietary and living conditions.

When the cancer death rates of the white population for 1933 to 1944 in the Continental United States were adjusted to the age distribution of the total population of the United States, as enumerated in the census of 1940, the annual average increase in the rate for males was 0.76 per cent, while that for females decreased 0.38 per cent annually.

DAVID H. LYNN, M.D.

## DUCTLESS GLANDS

**Anatomic and Clinical Study of Spontaneous Parathyroid Tetany in the Adult.** Symptomatic Importance of Radiologic Parathyroid Calcifications. (Etude anatomoclinique des tétanies parathyroïdiennes spontanées de l'adulte. Valeur sémiologique des calcifications parathyroïdiennes radiologiques.) M. LAURAT and R. BERTHE. *Ann. endocr. Par* 1947 8: 17

The authors discuss 7 cases of tetany of parathyroid origin in adults. One case was of their own observation, the others were reported in the literature.

Histologic studies of parathyroid glands in cases of tetany in infants as well as in adults show that the causative lesion may be hemorrhage, tuberculosis, amyloidosis, or syphilis. Of these, hemorrhage, either minute or large, seems to be the most frequent occurrence.

The authors discuss in detail the normal and pathologic anatomy and histology of the thyroid and parathyroid glands, and stress the difficulties which sometimes arise in differentiating parathyroid tissue from a colloid vesicle of thyroid tissue or a toxic adenoma. Even experienced surgeons have mis-

taken one for the other in biopsies or in removal for therapeutic purposes. These difficulties are even greater in cases of pathology of the thyroid and parathyroid, especially in tuberculosis in which the characteristic structure of the parenchyma is more or less destroyed.

Attention is drawn to a fact which has not been described before: there are small areas of calcification in the diseased glands, mostly located at the capsule and irradiating into the thyroid tissue. These calcifications can be demonstrated with x rays and, in certain cases, may be helpful in establishing the diagnosis.

The occurrence of spontaneous parathyroid tetany in adults seems to be extremely rare as the authors found only 6 cases reported in the entire literature since 1903. **WERNER M. SOLMITZ, M.D.**

### SURGICAL PATHOLOGY AND DIAGNOSIS

**The Role of the Spleen in Relation to Cutaneous Wound Healing** (Mifla e potere di riparazione delle ferite cutanee) **MARIO PELLOJA, Arch. Ital. chir.** 1947 69 128.

The author studied the influence of splenectomy or ligation of the splenic artery on cutaneous wound healing.

Seven groups of animals were used experimentally. A dorsal cutaneous wound was made in each animal. The first group was the control group in which only the dorsal cutaneous incision was made. It took 1 month for scar formation, and from 11 to 13 days for a 30 per cent reduction of the size of the wound to take place.

In the second group a laparotomy was performed in addition to the cutaneous wound made on the dorsum as in the control group.

Splenectomy was performed in the third group. Ligation of the splenic artery was carried out in the fourth group. In the fifth group the dorsal wound was made 15 or 20 days after the laparotomy. The dorsal wound was made 15 or 20 days after splenectomy in the sixth group and in the last group the dorsal wound was made 15 or 20 days after the splenic artery was ligated. The following results were obtained:

In the second group the wound was reduced 9.2 mm. per day; in the third group the wound was reduced 6.8 mm. per day; in the fourth group the reduction was 6.7 mm. per day; in the fifth group it was 13 mm. per day; in the sixth group 15 mm. per day; and in the last group the reduction was 11 mm. per day.

The experiments show that healing is retarded following intervention in contrast to cases in which the wound was made from 15 to 20 days after the intervention in which healing was faster than in the control animals. On the basis of these experiments, the author doubts the existence of a real specific function of the spleen to regulate cutaneous scarification; however, he attributes the changes to the general repercussion of the operative trauma.

The author has seen the greatest velocity of cicatrization from the fourth to the twelfth day while the average velocity was 11.5 mm. daily.

**ARTHUR F. CIPOLLA, M.D.**

**A Technique of Dissociation and Measurement of the Principal Physicochemical Factors of Blood Sedimentation** (Une technique de dissociation et de mesure des principaux facteurs physico-chimiques de la sédimentation sanguine) **M. F. JAYLX and J. BADIN, Rev. Méd. 1947 3 283.**

The sedimentation speed of the red cells as obtained by the method of Westergren is the result of several variable factors, all of which do not have the same physiopathologic significance. Therefore the authors have worked out a relatively simple method for the separate study of the three kinds of factors which condition this speed: (1) the red cell factor which includes the number of cells, their average weight and other individual factors; their tendency to reversible aggregation (Frimberger factor) and their exponential distribution conditioned by the more or less marked heterogeneity of the cell aggregations and of the cells themselves; (2) the plasma factor (fibrinogen considered from the qualitative and quantitative points of view) and (3) the serum factor which is complex and in which must be considered the rate of certain alpha globulins of glycoprotein nature, particularly haptoglobin.

The following figures represent the averages obtained from the blood of 10 normal young women:

Hourly sedimentation speed in vertical tube	6 mm
Number of red cells (height of sediment	
24 hours in inclined tube x 3)	4,558,000
Sedimentation speed in saline solution	25
Factor of Frimberger	30
Sedimentation exponential	15 for 6 mm.
Serum factor	14
Plasma factor	23

The averages obtained from the blood of 5 normal young men seemed to differ from those found in normal young women only in the number of red cells which was 5,300,000.

The causes of error connected with the technique are the variations in temperature which seem to be particularly serious for sedimentation in the inclined tube, the variations in the number of red cells due to the use of an incorrect amount of cell mass washed in the various mixtures, the presence of air bubbles clinging to the cell aggregations, the qualitative differences between the arabic gums of different origins, the alteration occurring in the gum solution as it becomes older, the isotonicity and approximate neutrality of the saline solution and the difficulty of certain readings because some bloods behave like heterogeneous suspensions and the upper limit of their column is difficult to ascertain although under good lighting and with some training it is nearly always possible to obtain a reading 95 per cent correct.

The authors demonstrate the clinical interest of their method by 3 examples in which the patients

presented an hourly sedimentation speed of about 60 mm. in critical tubes and would have been considered previously as having the same physiologic disturbance. In reality the new method shows that the acceleration of the sedimentation is due principally to hypoglobulia and secondarily to the fibrinogen in the first patient, principally to the serum factor and to fibrinogen in the second and nearly exclusively to the fibrinogen in the third. This already suggests a differential diagnosis. In fact, the first woman had had a serious hemorrhage after delivery, the second had a beginning phlebitis, and the third woman had a normal pregnancy at term with its normal hyperfibrinemia of 5 gm.

RICHARD KEMEL, M.D.

**Some Effects of Experimental Thermal Burns on Vascular Endothelium Employing a Perfusion Technique in Anesthetized Dogs.** TAOUER C. CRISHOLM and ESTHER HARDENBERGER. *A. Surg.* 1943, 7: 75

The authors report a method for perfusing the vascular tree of the hind leg of an anesthetized dog with a hot solution of 6 per cent gum acacia in normal saline solution in order to study the injury to the vascular endothelium. They label conventional methods for producing experimental burns as relatively crude insofar as they affect many vital structures simultaneously and unselectively.

The experimental technique is carefully described. Periods of observation following perfusion ranged from 4 to 36 hours. Foot volume lymph flow lymph protein concentration, temperature of the animal, arterial blood pressure, pulse and respiration, blood hematocrit, photographs of the hind legs and skin temperature on the hind feet were noted. Also selected skin biopsies, exploration of the perfused vessels and controls, and microscopic study of selected vessels were made.

Local dissection and the application of a tourniquet did not contribute to changes in vascular permeability with subsequent swelling of the extremities in the control animals. Perfused legs, however, showed edema, increase in lymph flow and changes in lymph protein content. Anoxia attendant on perfusion apparently did not contribute significantly to these results. When the rate of flow was brisk and the period of flow not too prolonged the incidence and magnitude of swelling was in direct relation to the temperature of the perfusate. When the perfused solution entered at 36° C. changes were meager and readily reversible, but at 75° C. the changes were severe and progressive.

Microscopic examination of skin biopsy specimens from swollen feet of animals perfused with solutions heated above 60° C. or beyond 10 minutes of perfusion time showed subcutaneous edema, congested capillaries, dilated lymphatics, and extravasation of the red cells into the intercellular spaces. The endothelial coat of veins from such legs showed a disruption of the geometric endothelial pattern with fragmentation and disappearance of the lining cells.

Under these experimental conditions, there was no evidence of the existence of immediate shock, nor was any answer found to the question whether hemocoagulation results from release of toxic substances or a shift in body fluids. Neither bacteria nor their toxins contributed to the findings, although no animal was studied longer than 36 hours.

Experimental data indicated that the duration and rate of flow of the perfusion play a role in altering the permeability of the vascular endothelium as judged by the incidence of leg swelling, rate of lymph flow and alterations of lymph constituents.

S. LLOYD TETTELIN, M.D.

## EXPERIMENTAL SURGERY

**Experimental and Clinical Studies of Reduced Temperatures in Injury and Repair in Man. Structure and Potentialities of Human Skin in Temperature Control and in Defense against Thermal Trauma.** HAMILTON BAXTER and MARTIN A. ERTM. *Plast. Reconstruct. Surg.* 1947, 2: 359.

The understanding of the reaction of human tissue to reduced temperatures of various degrees of severity is becoming more urgent in recent years. Modern warfare subjects large numbers of individuals to the influence of either prolonged moderate cold, as in immersion foot suffered by shipwrecked mariners, trench foot prevailing among the infantry personnel, or to the action of severe cold as in high altitude flying. The casualties due to cold have been particularly large in the American, German, and Russian armies of World War II.

Studies of the limit of endurance of army personnel under the influence of low temperatures are in progress in northern territories. Elective refrigeration has had many advocates for the purpose of anesthesia and as a means of treatment of gangrene and other vascular disorders. Moreover being a "thermal injury" understanding of the pathogenesis of injury by cold and the study of the reaction of human tissue to various degrees of reduced temperature should also throw some light upon the problem of burns and other allied types of trauma.

The purpose of this investigation was to study the direct effect of a sequence of cold temperatures on the human tissues (skin grafts) free of vascular and nerve elements and subsequent correlation of these observations with (a) the effect of cold on normal intact skin, (b) the effect of cold on healing and freshly healed surfaces all under controlled conditions, and (c) with the findings in actual clinical cases. It was hoped that a better understanding of the pathogenesis of injury by cold, the effect of cold on wound healing, and a more effective approach to treatment would result.

Human tissues thrive best at the temperature of 98° to 99° F. (37°C.) and this is the level at which the balance of heat production and heat loss is maintained.

The existence of a special organ makes regulation of body temperature and adaptation of the human

body to variations of environment more effective. This organ is the skin.

Exposure of living tissue to different temperatures produces alterations in the rate of metabolic processes commensurate with the effect on the rate of chemical reaction and enzyme action.

It is conceivable that cold may damage the cell sufficiently to cause a disintegration of the cell membrane, yet not completely destroy the enzymes thus released. Such enzymes could act upon the distant unaffected cells by coming in contact with them when the normal temperature is restored.

When a portion of the human body is locally chilled or frozen, there results a gradation of temperatures which may range from a very low level at the surface of the skin (If carbon dioxide snow was used for example, through the different levels of temperatures until normal body temperature is reached at some distance from the skin surface the metabolic alteration will be proportional to the temperature at a particular level and will prevail only as long as the temperatures are maintained but the destruction of the integrity of cells and sequelae of the physico-chemical alterations of living matter may become apparent only after a lapse of time.

In view of the previously considered factors it becomes imperative to carry out investigations and observations under conditions in which the interplay of the various factors is known or can be determined at all times, and compatible controls are constantly available. Such a set up has not been invariably obtained but the authors have attempted to get as near as possible to it. They chose dermatome donor sites (areas from which a uniform thickness of skin had been removed with the Padgett Hood dermatome) on the thigh as the standard area. Fresh dermatome donor sites have several features which make them particularly suitable for the study of the influence of a specific factor on wound healing.

The range of the temperatures studied and the details of the methods of cooling will be incorporated in a subsequent paper.

In order to separate the different elements involved in the influence of moderate or severe cold on the tissue so that the study of the direct effect of cold could be carried on the authors selected the free split-thickness dermatome skin graft. Free skin grafts are peculiarly suitable for such a study (a) they are uniform in thickness (b) they are deprived of nerve and blood supply (c) they can be subjected to various measured temperatures for definite periods of time and (d) they can be replaced on a suitable bed in the host where their behaviour can be studied by biopsies and other methods.

The range of temperature extended from 39 to  $-108^{\circ}\text{F}$  ( $4$  to  $-78^{\circ}\text{C}$ ) and the time of exposure varied from a few hours to several months. The details of this method will be described in subsequent reports.

Observations were carried out on the vascular response of normal intact skin to the influence of a whole range of cold temperatures. This was

compared with the reaction of (a) recently healed donor sites where the restitution of the nervous system had not yet taken place (b) pedicle flaps deprived of their nervous connection with the body and (c) the recently healed and old skin grafts. Thus the authors were able to interpolate the role of nervous elements in the summation of reactions to cold and freezing.

In actual clinical cases other factors must be considered which may play a contributory and even a determining part in the final outcome of the injury by cold. These include the state of peripheral circulation in the individual the presence of specific vascular disease the individual susceptibility to cold the condition of the skin of the exposed part the local factors which prevail at the time of exposure (e.g. wetness constriction immobilization) and many others. Some of these factors have been appraised by studying the effect of reduced temperatures on healed scars donor sites skin grafts and tube pedicles under conditions in which the temperature as well as the duration of the exposure was known.

Thus it is possible to correlate the information obtained from the experimental studies with the clinical problems in which the condition of exposure to cold is unknown and the extent of tissue damage and prognosis are not immediately determinable.

LOUIS T BYARS M D

**Control of Hemorrhage from Wounds of the Heart by the Gelatin Sponge Patch Technique.**  
HILGER PERCY JENKINS, HOWARD OWEN EDWARD SENZ, and ROBERT W JAMPOLIE. *Ann Surg.*, 1947  
126 973

The use of the gelatin sponge for hemostasis has previously been reported in cases of bleeding from wounds of the liver kidneys spleen vena cava and aorta.

In this experiment on dogs, a wound was made in the right or left ventricle with a scalpel to permit a large profuse spurt of blood with each systole. A sheet of dry compressed gelatin sponge was applied over the spurting wound and held in place by the operator's fingers with moderate pressure synchronized with the contractions of the heart while traction was made on a suture passed through the apex. Pressure was maintained over the patch for from 3 to 5 minutes for wounds of the right ventricle and from 5 to 13 minutes for wounds of the left ventricle. After this period of time the patch was usually sufficiently adherent to control the hemorrhage completely. After from 20 to 30 minutes the patch was usually firmly adherent to the heart and some times difficult to remove because of its fibrous fixation to the wound. The pericardium was sutured and the wound in the chest closed.

It was rather an important point in the technique to maintain even pressure on the patch so that when the blood clotted in the sponge, the patch would become adherent about the wound as a result of the liberation of fibrin during the clotting process. The



dry compressed sponge would stick to the gloved fingers very easily. Moistening the gloves with saline solution just before applying the patch would usually suffice to prevent this. A piece of perforated celloid over the patch will prevent the sponge from sticking to the gloves. The celloid should always be removed.

In a series of 15 experiments, the wound was made in the right ventricle in 4 cases and in the left ventricle in 11. The hemorrhage was completely controlled by the application of a gelatin sponge "patch" and the animal survived the immediate postoperative period. Six other animals died from ventricular fibrillation when the pericardial sac was opened or when the wound was made in the heart. The most satisfactory means of preventing fibrillation appeared to be careful handling of the heart and especially avoiding torsion.

In the series of 15 animals 5 died between 2 and 12 days from distemper pneumonia, or empyema. One died after 3 days from pneumonia but also had an intracardiac thrombosis due to the migration of the sponge patch into the cardiac chamber. In 2 of the animals there was a grayish appearance of the pericardial sac suggestive of an early pericarditis although no exudate was present.

There was no evidence of blood in the pericardial sac. The closure of the pericardium appeared to be adequate additional support to the sponge to prevent subsequent blowing off of the patch.

The gelatin sponge patch was firmly adherent to the heart, and usually only lightly adherent to the overlying pericardium. As a rule, the sponge appeared to undergo absorption in about 2 months. After several weeks the wound was healed by a well differentiated fibrous tissue scar.

Aside from the hemostatic effect of the sponge, it should also be pointed out that the sponge patch provides protective cover to the wound and gives it support during the process of wound repair.

The gelatin sponge may provide a means of obtaining immediate control of hemorrhage from a wound of the heart and at least momentarily preventing further loss of blood. It is thoroughly possible that with the hemorrhage controlled in this fashion, one could then very gently peel back the sponge and insert the suture in a relatively dry field or the suture could be placed in the wound and tied over the patch of sponge covering the wound. In wounds adjacent to the coronary vessels the gelatin sponge patch alone may suffice.

GEORGE W. RICHARDSON M.D.

# SURGERY

## GYNECOLOGY AND OBSTETRICS

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### PORTACAVAL SHUNTS IN THE TREATMENT OF PORTAL HYPERTENSION

An Analysis of 15 Cases with Special Reference to the Suture Type of  
End-to-Side Splenorenal Anastomosis with Splenectomy and  
Preservation of the Kidney

ROBERT R. LINTON M.D. F.A.C.S., IRAL B. HARDY, Jr. M.D. and  
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**P**ORTAL hypertension develops secondary to partial or complete obstruction of the portal blood flow in human patients. The site of the block may be either in the liver the intrahepatic type or in the portal venous system, the extrahepatic type, as has been pointed out by Whipple (20). Esophageal varices develop as a result of either type of block. These vessels are one of the main collateral channels through which nature shunts the blood flow around the site of obstruction from the portal bed to the systemic venous system. This shunt is obviously ineffective for two reasons. First, the fact that portal hypertension persists indicates the inadequacy of it in shunting the large volume of portal blood flow and, second, severe hemorrhage from rupture of the esophageal varices often occurs and may eventually cause death. Since the demonstration in 1877 by Eck that it is possible to anastomose the portal vein to the inferior vena cava in experimental

animals a number of surgeons in the past have attempted shunt operations in patients with portal hypertension (7, 9, 13, 16) according to Whipple (20). These attempts at direct venous anastomoses were rarely successful undoubtedly due to technical difficulties so that for several decades the indirect type of anastomosis the Talma Morison (14, 18) operation or omentopexy was frequently performed. An occasional patient was benefited temporarily especially if splenectomy was also done. The majority, however, were not improved so the operation practically has been abandoned.

The recent perfection by Blakemore and Lord (3) of blood vessel anastomoses by the nonsuture technique utilizing vitallium tubes has restimulated surgeons in attacking the problem of portal hypertension. Whipple (20) and Blakemore and Lord (4) were the first to report a group of patients in which this method of venous anastomosis was utilized to produce portacaval shunts. They described two types of shunt (1) an end-to-end anastomosis between the splenic vein and left renal vein with splenectomy and nephrectomy and (2) an end-to-side anastomosis between the end

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of the portal vein and the side of the inferior vena cava. The results in their cases have been so encouraging that it has stimulated us to a renewed attack on the problem.

The purpose of this paper is to discuss various types of portal bed block and to report a group of 15 cases in which patients have been treated by various types of shunt operations with particular reference to the suture type of end to-side splenorenal anastomosis with splenectomy and preservation of the left kidney.

#### TYPES OF PORTAL BED BLOCK

Portal bed block may be one of two types, intrahepatic or extrahepatic as pointed out by Whipple (20) or a combination of both.

TABLE 1—TYPES AND ETIOLOGY OF PORTAL BED BLOCK MASSACHUSETTS GENERAL HOSPITAL

- I. Intrahepatic—
  - A. Portal cirrhosis (Laennec type) with or without cavernomatous transformation of the portal vein.
  - B. Thrombosis of hepatic veins.
- II. Extrahepatic (Banti's syndrome)—
  - A. Congenital—obliteration of the portal vein with cavernomatous transformation.
  - B. Acquired—thrombosis of the portal vein or its tributaries
    - 1. Infectious
    - 2. Traumatic
    - 3. Spontaneous
- III. Combined type—
  - Portal cirrhosis with portal vein thrombosis.

The relative frequency of the two types has not been determined because of the lack of statistical data. The most common form of intrahepatic block results from portal or Laennec's cirrhosis secondary to the scar tissue replacement of the liver parenchyma. The block is distal apparently to the hepatic veins since Herrick showed that in the normal liver perfusion of the hepatic artery alone with a manometer connected with the portal vein produced a 1 millimeter rise of mercury in the latter for every 40 millimeters rise in the former while in the cirrhotic liver there was a 1 millimeter rise in the portal vein for every 6 millimeters in the hepatic artery. These observations indicate that a considerable volume of the hepatic artery blood flow is blocked from entering the hepatic veins and is shunted back

into the portal vein thus increasing the blood flow through the collateral channels. It seems possible under these conditions that a type of an arteriovenous fistula is produced in the liver which if true would tend to increase the volume flow of blood in the portal system. Six patients in the report had a portal bed block of this type. The other type of intrahepatic block is secondary to thrombosis of the hepatic veins. This condition is relatively uncommon but when it occurs is usually fatal.

The extrahepatic portal bed block (so called Banti's syndrome) may be either congenital or acquired. The liver is normal early in the course of this type of disease but in the later stages may develop cirrhosis. The block in the former occurs in the portal vein and is usually due to fibrous or scar tissue. Whipple (20) has pointed out that it occurs probably from an extension into the portal vein of the process which obliterates the umbilical vein and the ductus venosus following birth. This explanation appears plausible since this type of the disease may occur early in life. Severe hematemesis occurred in 2 of our patients at the ages of 6 and 7 years, respectively. These children had had no serious illnesses or injuries since birth that might have caused the acquired form of portal block. Four other cases in this group of patients can be added to these since the disease manifested itself before 20 years of age.

The acquired type is thought to develop secondary to a thrombosis of the portal vein or one of its main tributaries, especially the splenic vein as pointed out by Warthin in 1910. The etiology of the thrombosis may be either infectious, traumatic, or spontaneous in origin. As in venous thrombosis elsewhere there may be partial canalization of the involved vessels and possibly portions of the thrombus may break off to produce portal emboli, thereby increasing the degree of portal bed block. Eight patients in this report had the extrahepatic type of portal bed block, 6 were classified in the congenital group and 2 in the acquired.

A combination of the two main types, the intrahepatic and extrahepatic, It  
 1 in 2 of the patients  
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 1 in 2 of the patients  
 cases 2 and 3. WB

scribes another form of extrahepatic block, the so called cavernomatous transformation of the portal vein. Some authorities believe this may represent a vascular neoplastic lesion, an angioma in the hepatoduodenal ligament. *It is our opinion however that the myriad of small blood vessels encountered in this region in many of the patients probably represents collateral channels that have developed as a result of the block in the portal system.* Attempts to perform a direct anastomosis between the portal vein and the inferior vena cava had to be abandoned in several patients both with and without cirrhosis because of the extreme vascularity of this area. Similar vessels have been encountered frequently in the splenic and retroperitoneal regions during the performing of the splenorenal type of shunt. It would appear therefore that this type of vascular lesion in the region of the portal vein itself does not represent a specific form of extrahepatic block but may develop as a result of portal vein obstruction whatever the cause. Why it occurs in some cases and not in others is difficult to explain unless it is the degree of block and the duration of it.

#### DIAGNOSIS

Patients with portal hypertension secondary to a portal bed block, as a rule seek medical advice because of a sudden massive hematemesis. Melena in a few instances although far less frequently may be the first symptom since bleeding may occur elsewhere in the gastrointestinal tract especially in the stomach where large dilated veins are frequently encountered. Portal hypertension therefore should always be considered in the differential diagnosis of hematemesis or melena. There are few if any specific premonitory symptoms of the disease. Physical examination as a rule reveals an enlarged spleen, the so-called congestive splenomegaly. Blood examinations show a secondary anemia, a leucopenia and a thrombocytopenia. If the block is intrahepatic, the liver may or may not be enlarged whereas in the extrahepatic type it is usually normal in size. Further differentiation between the two types is determined by liver function tests. As a rule when the block is intrahepatic, there is a high retention of brom-

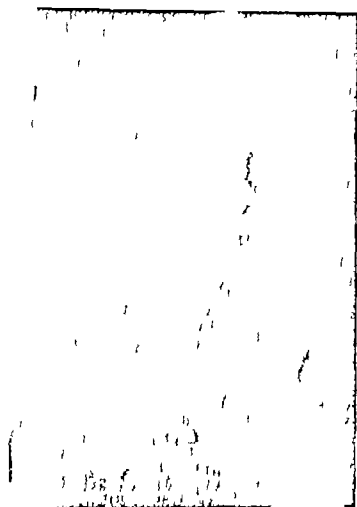


Fig. 1. A roentgenogram of the esophagus, showing dilated esophageal varices. This is the most definite method of diagnosis of portal hypertension.

sulfalein, a reversal of the albumin globulin ratio, a positive cephalin flocculation test and an elevated prothrombin time whereas normal liver function tests indicate an extrahepatic block.

Röntgenologic examination of the esophagus with barium to determine the presence or absence of varices especially at the lower end of this organ is the most important diagnostic procedure in patients suspected of having portal hypertension. The method has been described fully by Schatzki (17) (Fig. 1). At the present time it is our belief that the presence of esophageal varices indicates portal hypertension secondary to either an intrahepatic or extrahepatic portal bed block.

#### CASE REPORTS—INTRAHEPATIC GROUP

CASE 1. M. L. V. No. 161562, a 30 year old white housewife was first admitted to the Massachusetts General Hospital on November 8, 1938 because of increased vaginal bleeding of several months

duration. A gastrointestinal series showed no esophageal varices. The patient was discharged on November 10, 1938. Second admission December 12 to December 23, 1938 was because of vaginal bleeding. Treatment consisted of dilatation of cervix and curettage of uterus. Third admission May 26 to June 16, 1939 again for vaginal bleeding. Treatment consisted of supravaginal hysterectomy. A biopsy of the liver revealed alcoholic cirrhosis. Fourth admission May 19 to May 29, 1943 was for the excision of a mixed tumor of the right parotid gland. Fifth admission December 23, 1944 to January 24, 1945 was because of a small hematemesis of 1 day's duration. The liver and spleen were readily palpable. Laboratory studies revealed red blood cells, 3.4 million hemoglobin 7.4 grams white blood cells, 11,000 prothrombin time, 28 seconds with a normal of 20 seconds. The total serum protein was 6.4 grams with an albumin-globulin ratio of 3.0. The cephalin flocculation was 4+ in 48 hours and the bromsulphalein retention was 15 per cent in 45 minutes. A gastrointestinal series revealed large esophageal varices. She was discharged home to report in 1 month to have a portacaval shunt performed. Sixth admission February 21 to March 24, 1945 was for operation, which was performed March 6, 1945. A splenectomy, left nephrectomy and an end-to-end splenorenal anastomosis was performed by Richard H. Sweet, who used the nonsuture method with a Blakemore vitallium tube. A liver biopsy showed moderate cirrhosis with some hepatic regeneration. The patient was last seen on August 8, 1947. She had had no episodes of bleeding, except a few streaks of red blood on her stools which were attributable to hemorrhoids. Red blood cells numbered 4.0 million hemoglobin 12.9 grams. A gastrointestinal series revealed no change in the esophageal varices.

This patient it is believed, is an example of intrahepatic portal bed block secondary to portal cirrhosis of the liver. She had had only one minor hematemesis prior to admission and none since the shunt was performed. Liver function tests repeated about 2 years after the operation showed slight improvement. Esophagoscopy performed 24 months after the operation by Edward B. Benedict, revealed the presence of a few varices which were injected with a sclerosing solution. The operative procedure consisted of a splenectomy, left nephrectomy and a Blakemore nonsuture type of end-to-end splenorenal anastomosis, the only one of this type in this report. The result to date is gratifying and gives us our longest follow up. At observation 29 months after shunt operation she had had no further bleeding which is encouraging although an esophagogram still showed esophageal varices.

CASE 2 C. P. No. 323 585 a 42 year old white male electrician was first admitted to the Medical Service of the Massachusetts General Hospital on June 13, 1942 because of repeated episodes of hematemesis and tarry stools of 5½ months' duration. During this time he had been admitted to outside hospitals on three occasions and received many transfusions. He admitted moderate alcoholic intake. Examination revealed a middle-aged man with a prominent abdomen and an enlarged liver and spleen. Laboratory studies revealed red blood cells, 4.8 million hemoglobin, 10.5 grams white blood cells, 7,500 total serum protein 6.3 grams albumin-globulin ratio, 1:1 nonprotein nitrogen, 32 milligrams, van den Bergh normal, cephalin flocculation, 3+ in 48 hours prothrombin time 30 seconds with a normal of 21 seconds. A gastrointestinal series showed extensive varices of the esophagus and stomach. The patient was discharged on June 22, 1942. Second admission December 24 to December 31, 1942 was because of hematemesis. Third admission, February 2, 1943 to April 7, 1943 was because of further esophagogastrintestinal bleeding. On March 1, 1943 a splenectomy was performed through a transthoracic exposure by Richard H. Sweet. Fourth admission, July 20 to July 24, 1943 was because of recurrent hematemesis. Fifth admission October 31 to December 23, 1943 was because of hematemesis of 4 days duration. Treatment was complicated by transfusion reactions and also a posterior myocardial infarction. Sixth admission, January 27 to February 3, 1944, was because of hematemesis. Seventh admission August 28 to August 31, 1944, was because of melena. Eighth admission April 5 to April 14, 1945, was because of hematemesis. Treatment consisted of a transfusion. Ninth admission, May 22 to June 8, 1945 was for severe generalized abdominal pain with a white blood cell count of 38,000. Treatment was conservative. Tenth admission August 20 to September 1, 1945, was because of hematemesis. Treatment consisted of esophagoscopy and injection of esophageal varices with 5 per cent sodium morrhuate solution. Eleventh admission, October 11 to October 24, 1945 was because of deep venous thrombosis of the left leg. Treatment consisted of bilateral superficial femoral vein interruption. Twelfth admission, November 15 to November 28, 1945, was to perform a portacaval shunt. Red blood cells numbered 4.5 million hemoglobin 9.4 grams nonprotein nitrogen, 16 milligrams per cent, total serum protein 6.64 grams and albumin-globulin ratio 1:77 prothrombin time 23 seconds with a normal of 18 seconds cephalin flocculation was 3+ in 48 hours. Operation was performed November 1, 1945. A suture anastomosis was made between the proximal end of the divided superior mesenteric vein and the side of the inferior vena cava by one of us (R. R. L.). The patient developed oliguria postoperatively for 48 hours and then his output increased but his nonprotein nitrogen rose steadily being 74, 116 and 154 milligrams per cent on the second third and fifth postoperative days. He had a terminal hemorrhage

by mouth and died on November 28 1945 one week following the operation. Autopsy revealed cirrhosis of the liver hemoglobin nephrosis and some pulmonary congestion and edema. The venous anastomosis was patent. There was evidence of old portal vein thrombosis with canalization.

This patient it is believed, is an example primarily of intrahepatic portal bed block secondary to portal cirrhosis but in addition complicated by portal vein thrombosis as proved at autopsy. Splenectomy in 1943 failed to relieve the portal hypertension, since repeated esophagogastrintestinal hemorrhages continued to occur the first one within 4 months of the splenectomy. It was decided that a portacaval shunt should be performed, although it was realized that his general condition and cardiac status were poor. The spleen having been previously removed precluded a splenorenal anastomosis and because of marked vascularity in the region of the portal vein a superior mesenteric vein to inferior vena cava anastomosis was performed in November 1945. The patient died from renal failure 1 week after the operation. It is believed in retrospect that a splenorenal anastomosis should have been done at the time the spleen was removed but unfortunately this operation was not in vogue at that time. The shunt operation was undertaken finally as a last resort 2 years later in a patient doomed to die from hemorrhage and whose general condition had deteriorated considerably during this period.

CASE 3 A. C. No 416 195 a 54 year old white porter was first admitted to the Massachusetts General Hospital on January 15 1945 because of massive and abdominal swelling of 3 weeks duration and one episode of hematemesis. Examination revealed a middle aged man with a distended abdomen with an enlarged liver and spleen and ascites. Laboratory studies revealed red blood cells 3.69 million hemoglobin 13 grams white blood cells 3.000 nonprotein nitrogen 23 milligrams per cent total serum protein 7.05 grams albumin globulin ratio 0.8 cephalin flocculation 4+ in 48 hours prothrombin time 29 seconds with a normal of 18 to 20 seconds bromsulphalein retention test showed 40 per cent retention. A gastrointestinal series was negative except for large esophageal varices. The patient was treated conservatively and was discharged improved on February 2 1945. Second admission December 29 1945 to January 31 1946 massive ascites and scrotal edema. The patient received blood transfusions and repeated abdominal paracenteses. The total serum protein was 5.04 grams albumin-globulin

ratio 0.98 cephalin flocculation was 4+ in 48 hours and bromsulphalein retention was 20 per cent in 45 minutes prothrombin time 38 seconds with a normal of 20 seconds but it improved to 25 seconds with a normal of 20 seconds. At operation January 28 1946 a suture anastomosis between the end of the portal vein and the side of the inferior vena cava distal to the renal veins was made by one of us (R. R. L.). A large partially organized thrombus was removed from the portal vein after the vein was divided. The patient became comatose on the second postoperative day and died on the third postoperative day. Autopsy revealed portal cirrhosis of the liver and a patent anastomosis between the portal vein and the inferior vena cava. The cause of death was thrombosis of the hepatic artery.

This patient it is believed is an example of intrahepatic portal bed block with a superimposed extrahepatic block from portal vein thrombosis. Despite marked vascularity in the gastrohepatic ligament consistent with the so called cavernomatous transformation of the portal vein a satisfactory portacaval anastomosis was performed. The patient however died on the third day after the operation due to thrombosis of the hepatic artery presumably from operative trauma. In retrospect it is believed that a splenectomy and a splenorenal type of anastomosis would have been the preferable operation because of the extreme vascularity in the region of the portal vein.

CASE 4 M. F. F. No 528,413 a 42 year old white male cab driver was first admitted to the Massachusetts General Hospital on April 7 1946 because of severe repeated hematemesis of 5 days duration. During the year before admission he had been hospitalized on 4 occasions because of hematemesis. Examination revealed a poorly nourished man with many spider telangiectases. The liver and spleen were both palpable. Laboratory studies revealed red blood cells 2.0 million hemoglobin 8 grams white blood cells 5,800 total serum protein 5.7 grams with an albumin globulin ratio of 1.09 the nonprotein nitrogen was 26 milligrams per cent the cephalin flocculation 3+ in 48 hours the prothrombin time was 28 seconds with a normal of 22 seconds serum bilirubin 1.6 milligrams per cent bromsulphalein was 36 per cent retention in 45 minutes. A gastrointestinal series revealed large esophageal varices. Before discharge on June 12 1946 he was esophagoscopied and some varices were injected with a 5 per cent solution of sodium morrhuate. Second admission July 19 to August 19 1946 was because of massive hematemesis. The patient was prepared for operation and a portacaval shunt was planned. At operation August 19 1947 the abdomen was opened through a long right subcostal incision by one of us (R. R. L.). Because of the extreme vascularity in

the region of the portal vein, it was impossible to isolate this blood vessel. Extensive bleeding was partially controlled with fibrin foam. The patient received 3 500 cubic centimeters of citrated blood and 5 000 cubic centimeters of blood by autotransfusion. He left the operating room in poor condition and never regained consciousness. He died about 5 hours following the operation. An autopsy revealed massive intra abdominal hemorrhage.

This patient it is believed is an example of intrahepatic portal bed block secondary to portal cirrhosis with a superimposed cavernomatous transformation of the portal vein. During the operation in which a portacaval anastomosis was attempted but had to be discontinued because of severe hemorrhage before the portal vein was isolated the patient received 17 citrated blood transfusions a total of 8 500 cubic centimeters of blood. The fact that his death resulted from hemorrhage would seem to indicate that patients with severely damaged livers apparently do not metabolize the citrate used as the anticoagulant in the transfusions. This patient received 2 125 cubic centimeters of a 1.3 per cent citrate solution. This amount in patients with normal livers has not produced incoagulability of the blood. In retrospect it is believed that it would have been better in this patient to have performed a splenectomy and a splenorenal anastomosis, or at least the operation should have been terminated when the extreme vascularity of the subhepatic region was recognized.

CASE 5 E. E. B. No. 505360 a 51 year old white business man was admitted to the Phillips House of the Massachusetts General Hospital on September 4 1945 because of weakness, apathy, and increase in abdominal girth of several months' duration. He gave long history of large daily alcoholic intake. Examination revealed a slight emaciated and icteric middle aged man with a fluid wave in the abdomen. His liver was enlarged the spleen could not be palpated. Laboratory studies revealed red blood cells 3.71 million white blood cells 8 700 serum protein was 5.2 grams albumin-globulin ratio 1.13 nonprotein nitrogen 8 milligrams per cent prothrombin time 3 seconds with a normal of 16 seconds serum bilirubin 2.16 milligrams per cent bromsulphalein test was 38 per cent in 45 minutes. A gastrointestinal series revealed large esophageal varices and liver biopsy showed extensive cirrhosis of the "alcoholic type." With conservative measures he improved and was discharged on November 21 1945. Second admission, June 7 1946 for study. Third

admission, August 8 1946 was because of hematemesis and for abdominal paracentesis. Fourth admission August 30 to September 1 1946 was for paracentesis. Fifth admission September 12 to September 7 1946 was for abdominal paracentesis. Sixth admission November 17 to December 12, 1946, was because of massive hematemesis. During this admission the patient continued to have repeated massive hematemesis. The patient was rapidly losing ground so an exploration was decided upon in the hope of accomplishing some form of portacaval shunt. At operation, December 10, 1946 a splenectomy with an end-to-side suture splenorenal anastomosis was done by one of us (R. R. L.). Following the operation the patient failed to recover consciousness. He developed pulmonary edema and oliguria and died December 12 1946 48 hours after the operation. Autopsy examination revealed extensive cirrhosis with massive hemorrhages from the varices. The anastomosis was patent.

This patient, it is believed is an example of intrahepatic portal bed block secondary to portal cirrhosis treated by splenectomy and splenorenal anastomosis. Injection of the esophageal varices with a sclerosing solution before operation did not control the bleeding from them. During the 5 days before operation, he vomited repeatedly large amounts of blood so that a splenectomy and a splenorenal anastomosis were performed as a last resort and as an emergency procedure. In retrospect it is believed that this type of patient was too critically ill to attempt such a formidable operative procedure. Perhaps earlier in the course of his disease before he had become so depleted it might have been successfully performed.

CASE 6 B. P. M. No. 561 984, a 54 year old white male restaurant owner was first admitted to The Baker Memorial Hospital on January 26, 1947 because of chills, fever and jaundice of 8 days' duration. He had been a heavy drinker. Physical examination showed a jaundiced middle-aged man with ascites. Laboratory studies revealed red blood cells 3.5 million hemoglobin 11 grams white blood cells 8 500 nonprotein nitrogen 21 milligrams per cent total serum protein, 8.16 grams with an albumin globulin ratio of 0.77 cephalin flocculation was 4+ in 48 hours prothrombin time was 27 seconds with a normal of 18 seconds van den Bergh was 4.2 milligrams per cent bromsulphalein test was 40 per cent retention in 45 minutes. A gastrointestinal series was suggestive of esophageal varices. Repeated paracenteses were performed because of rapid reaccumulation of abdominal fluid. A liver aspiration biopsy done by Wade Volwiler on February 6 1947 showed a marked degree of cirrhosis with extensive

dilatation of the venous sinusoids and narrowing of the liver cord cells. Despite this poor liver function it was felt that his disease was fatal unless a portacaval shunt could be performed. At operation April 7, 1947 a splenectomy and an end to side suture splenorenal anastomosis were done by one of us (R. R. L.). The operative field was very vascular. It was necessary to give the patient many transfusions and after 15.6 of them bank blood and 9 auto-transfusions it was noted that the patient was bleeding more profusely and the blood would not clot. In spite of 6 grams of intravenous calcium and vitamin K the bleeding continued. The operative incision was closed around the suction tip through which the blood was a pirated and given back to the patient. In all he received by vein a total of approximately 27,000 cubic centimeters of blood. All but 3,000 cubic centimeters of this was by autotransfusions. He rapidly failed and died 2 hours after the operation. Autopsy was not permitted.

This patient it is believed is an example of intrahepatic portal bed block secondary to portal cirrhosis of the liver, with a superimposed thrombosis of the hepatic veins. This latter diagnosis was suggested by Chester M. Jones because ascites developed suddenly and reaccumulated extremely rapidly and an aspiration biopsy of the liver showed extensive dilatation of the venous sinusoids. Operation was undertaken in this patient as a last resort. In retrospect it is believed that he was a patient with a liver too severely damaged to withstand such a long extensive surgical procedure. His case demonstrates also the inability of a badly damaged liver to metabolize the citrate used in multiple blood transfusions.

CASE 7. C. D. No. 577,750 a 51 year old white man was admitted to the Massachusetts General Hospital on June 9, 1947 because of recurrent episodes of hematemesis of 8 months duration. In April 1947 a diagnosis of bleeding duodenal ulcer was made at another hospital. As a result an exploratory laparotomy was performed at which time a diagnosis of cirrhosis with portal hypertension was made. Hematemesis developed 7 days after the operation, and he was transferred to the Massachusetts General Hospital. Physical examination revealed a pale, scrawny man. The liver and spleen could not be palpated. Laboratory studies revealed hemoglobin 8 grams, white blood cells 3,500, prothrombin time 20 seconds with a normal of 15 seconds, nonprotein nitrogen 27 milligrams per cent, total serum protein, 7.49 grams, albumin-globulin ratio 1:7, cephalin flocculation test was 3+ in 48 hours, the van den Bergh was normal, the bromsulphalein test 12 per cent retention in 45 minutes. Roentgenogram of the esophagus showed extensive esophageal varices. A

diagnosis of portal cirrhosis with a relatively good liver function was made and a portacaval shunt recommended. On June 23, 1947 a splenectomy and an end to side suture splenorenal anastomosis were made by one of us (R. R. L.). The patient made an uneventful convalescence and was discharged on July 6, 1947, 13 days following the operation. A check up 2 months after the operation revealed that the patient was in excellent condition and had no further epigastric gastrointestinal bleeding.

This patient it is believed is an example of intrahepatic portal bed block secondary to cirrhosis of the liver. The liver function test showed light to moderate disease. Attention should be drawn to the fact that the diagnosis of cirrhosis with esophageal varices was missed in hospital because the roentgenologists failed to visualize the esophagus carefully. As a result the patient was put through an unnecessary laparotomy before the diagnosis was made. The result to date is encouraging but further observation is necessary.

#### CASE REPORTS INTRAHEPATIC GROUP

CASE 1. M. N. 21,099 a 12 year old white boy was first admitted to the Massachusetts General Hospital on December 1, 1929 because of hematemesis. He had been admitted to the Children's Hospital Boston in 1925 and 1927 because of similar episodes. In that institution he had been transfused and his bleeding stopped spontaneously. After his admission to the Massachusetts General Hospital a splenectomy was performed through an abdominal approach by Arthur W. Allen. The patient did well and was discharged on January 25, 1930. Second admission November 11 to December 24, 1930 was because of repeated hematemesis. On December 12, 1930 re-exploration of the abdomen by Allen and the dilated veins in the gastrohepatic omentum were ligated. Third admission January 15 to January 27, 1931 was for a tonsillectomy. Fourth admission April 23 to May 16, 1932 was for hematemesis. Fifth admission February 14 to February 25, 1937 was because of hematemesis although he had been well for a period of 5 years. Sixth admission December 15 to December 16, 1944 was because of hematemesis. Treatment consisted of esophagoscopy with injection of varices with 5 per cent solution of sodium morrhuate. Seventh admission January 8 to January 9, 1945, was for esophagoscopy with injection of esophageal varices. Eighth admission February 24 to March 14, 1945 was for relief of hematemesis. Multiple transfusions were administered. Ninth admission April 9 to April 10, 1945 tenth admission May 14 to May 15, 1945, eleventh admission July 13 to July 14, 1945 were for esophagoscopy and injection of esophageal varices. Twelfth admission September 27 to October



4 1945, was because of massive hematemesis. Laboratory studies revealed red blood cells, 4.4 million hemoglobin 85 per cent white blood cells 9,300 prothrombin time, 19 seconds with a normal of 16 seconds. At operation October 9, 1945 an end-to-side suture anastomosis between the proximal divided end of the superior mesenteric vein and the side of the inferior vena cava was performed by one of us (R. R. L.) The patient was discharged home 13 days following the operation. Follow-up He was seen on August 8 1947 22 months following the operation. He had had no bleeding and was working full time as a painter. A gastrointestinal series revealed no change in the esophageal varices.

This patient it is believed, is an example of extrahepatic portal bed block of congenital origin secondary to obliteration of the portal vein. He was treated by a superior mesenteric to inferior vena cava shunt. Surgical therapy including splenectomy transabdominal ligation of veins in the gastrohepatic ligament numerous injections of esophageal varices with sclerosing solutions, was ineffective in controlling hemorrhage from esophageal varices. These procedures had not controlled the portal hypertension since the portal pressure was found to be 47 centimeters of saline at the operation in 1945 a little more than four times the normal. The fact that 22 months have elapsed since his portacaval anastomosis without further bleeding is encouraging that this operation may have been successful in reducing the portal hypertension. His case is of especial interest since he appears to be one of the previously splenectomized patients that has been salvaged and in addition one of 2 patients apparently successfully treated by anastomosis between the superior mesenteric vein and the inferior vena cava. The other was by Bogarts in 1913 according to Whipple (20).

CASE 9. R. M. No. 516,023, a female child, aged 6 years was first admitted to the Children's Medical Department of the Massachusetts General Hospital on January 6, 1946 with a complaint of fever and nose bleeds of 4 days duration. Physical examination revealed a small, pale young girl. The liver was normal in size and the spleen enlarged. A gastrointestinal series revealed one large varix visible at the lower end of the esophagus. The findings were consistent with so-called Banti's syndrome. Laboratory studies revealed red blood cells, 3.5 million hemoglobin 9 grams white blood cells, 6,000 prothrombin time, cephalin flocculation, bromaulsolin and van den Bergh tests were normal serum protein, 6.34 grams albumin-globulin ratio 2:14 nonprotein

nitrogen 24 milligrams per cent. The patient's condition gradually improved and she was discharged on February 6 1946 with a diagnosis of pancytopenia. Second admission, April 27 to July 13 1946 was because of severe hematemesis. Laboratory studies revealed red blood cells 1.9 million hemoglobin, 4.4 grams white blood cells, 47,000 serum protein, 4.9 grams. The patient's diagnosis was reconsidered and it was decided in view of the hematemesis, the esophageal varices and the enlarged spleen that treatment should consist of a splenectomy and a splenorenal shunt. At operation June 4, 1946, a splenectomy and an end-to-side suture type of splenorenal anastomosis were performed by one of us (R. R. L.) The postoperative convalescence was complicated by a massive hemothorax and hemoperitoneum believed secondary to the administration of heparin for 7 days following the operative procedure. The patient, however, made a slow but satisfactory convalescence following this serious complication and she was discharged 39 days after the operation. Follow-up The patient returned to school in October 1946. She was seen on August 8 1947 was leading a normal, active existence without further hematemesis. Blood studies revealed hemoglobin, 12.5 grams red blood cells, 4.25 million, white blood cells, 7,000. A repeat roentgenogram of the esophagus showed no change in the esophageal varices.

This patient it is believed is an example of extrahepatic portal bed block of congenital origin secondary to obliteration of the portal vein, treated by a splenectomy and an end-to-side splenorenal shunt. Measurements of portal pressure indicated that the shunt was functioning since the initial level at the time of the operation was 49 centimeters of saline and following the splenectomy and splenorenal anastomosis it had dropped to 21.5 centimeters of saline. The well being of the patient and the absence of further hemorrhages from the gastrointestinal tract for a period of 14 months since the operation was performed are encouraging and indirect evidence that the portal hypertension has been reduced.

CASE 10. J. M. No. 36, a 19 year old white male dental mechanic, was first admitted to the East Medical Service of the Massachusetts General Hospital on November 6 1935 because of melena associated with epigastric distress. The liver and spleen were both palpable. A gastrointestinal series revealed extensive esophageal varices. A diagnosis of Banti's disease was made. On December 5 1935 the splenic artery was ligated in continuity by Beth Vincent and an extensive omentopexy was performed. The patient was discharged December 20, 1935. Second admission, January 2 to March 2, 1937 was because of hematemesis and melena. He had repeated massive

hematemesis while in the hospital. A second operation by Arthur W. Allen was performed. Several large veins on the diaphragm and along the lesser curvature of the stomach were ligated and a further omentopexy was performed. Third admission February 14 to March 17 1939 for melena. Fourth admission April 28 to May 16 1939 fifth admission August 21 to September 5 1939 sixth admission February 7 to March 2 1940 seventh admission August 16 to September 26 1940 were for melena. Eighth admission October 31 to November 6 1940 was for esophagocopy. Ninth admission November 7 to December 23 1940 was for melena. Five esophagoscopies with injection of varices with 5 per cent solution of sodium morrhuate were performed. Tenth admission January 9 to February 6 1941 was for esophagocopy and injection of varices. Eleventh admission February 13 to March 13 1941 for melena esophagocopy and injection of varices. Twelfth admission April 14 to May 2 1941 was for melena esophagocopy and injection of varices were performed. Thirteenth admission May 19 to May 21 1941 fourteenth admission June 27 to June 28 1941 fifteenth admission July 7 to July 8 1941 sixteenth admission July 9 to July 16 1941 seventeenth admission August 6 to August 7 1941 eighteenth admission September 19 to September 20 1941 nineteenth admission November 14 to November 15 1941 were all for esophagocopy and injection of esophageal varices. Twentieth admission February 5 to February 6 1942 was for attempted cannulation of an intercostal vein for phlebography. Twenty-first admission June 17 to June 26 1942 was for melena. Twenty-second admission July 25 to August 12 1942 was for operation—transthoracic exposure of esophagus with ligation of periesophageal veins by Richard H. Sweet. Twenty-third admission September 11 to September 12 1942 esophagocopy. Twenty-fourth admission November 5 to November 14 1942 because of melena. Twenty-fifth admission April 4 to May 13 1943 because of hematemesis and melena. Twenty-sixth admission June 14 to June 15 1943 twenty-seventh admission March 17 to March 18 1944 twenty-eighth admission October 27 to October 28 1944 twenty-ninth admission March 3 to March 4 1945 thirtieth admission September 9 to September 10 1945 all for esophagocopy and injection of esophageal varices. Thirty-first admission March 28 to March 30 1946 was because of hematemesis and for esophagocopy and injection of varices. Thirty-second admission April 6 to May 29 1946 was because of massive hematemesis. Physical examination showed a markedly exsanguinated young man with an enlarged palpable spleen. Laboratory studies revealed red blood cells 3.0 million hemoglobin 9.0 grams serum protein 5.56 grams with an albumin-globulin ratio of 2.07 cephalin flocculation 3+ in 48 hours van den Bergh normal prothrombin time 23 seconds with a normal of 19 seconds, bromsulphalein test 6 per cent retention. It was decided in view of the past history of repeated esophagogastrintestinal hemor-

rhages that a portacaval anastomosis should be attempted. At operation April 24 1946 exploratory laparotomy through a right abdominal incision was done by one of us (R. R. L.). The portal vein was searched for but it could not be found. Massive bleeding was encountered. The common duct was accidentally transected and the cystic duct was injured necessitating a cholecystectomy and a cholecystojejunostomy according to Allen's (1) method. A portacaval shunt could not be performed. The patient made a satisfactory convalescence. Thirty-third admission June 6 to July 1 1946 was for a final attempt at a portacaval shunt. At operation June 8 1946 a splenectomy and an end-to-side suture type of splenorenal anastomosis were performed by one of us (R. R. L.). Six thousand cubic centimeters of citrated blood were used. The operation required 6 1/2 hours. The convalescence was satisfactory. The patient was discharged 23 days following the operation. Follow up. When seen on August 8 1947 14 months after the operation he felt well and had had no symptoms of bleeding. Hemoglobin was 17 gram white blood cells 10 000. The esophageal varices appeared the same by x ray.

This patient it is believed is an example of extrahepatic portal bed block of congenital origin secondary to obliteration of the portal vein. He was admitted to the hospital 33 times from 1935 to 1946. Eighteen of these admissions were for massive bleeding 12 for melena and 6 for hematemesis. The other 15 were for esophagoscopies and injection of esophageal varices. His case demonstrates the inefficacy of controlling portal hypertension by ligation of the splenic artery omentopexy ligation of the left gastric and coronary veins transthoracic ligation of the periesophageal veins and repeated injections of the esophageal varices with a sclerosing solution. A splenectomy fortunately had not been accomplished so that the splenic vein was still available with which to do a splenorenal shunt. The utilization of a thoracoabdominal approach multiple bank blood transfusions and autotransfusions and preservation of the left kidney it is believed were of extreme importance in the successful outcome of the shunt operation in this patient. It is still too early however to consider the patient cured following the shunt operation but at least he has had 14 months without evidence of bleeding.

CASE 11. F. L. No. 333 628 a 16 year old white school girl was first admitted to the West Medical Service of the Massachusetts General Hospital on December 25 1941 because of hematemesis. The

spleen was palpable below the costal margin. A gastrointestinal series showed large esophageal varices. The laboratory studies including bromsulphalein retention test, cephalin flocculation, van den Bergh prothrombin time, bleeding clotting time were normal. A diagnosis of congestive splenomegaly with esophageal varices was made. On January 10, 1947, through a transthoracic approach, Richard H. Sweet performed a splenectomy and ligated several large periesophageal varices. Patient was discharged on February 28, 1947. Second admission April 1 to May 3, 1946, was because of hematemesis. She was discharged to return later for a shunt operation. Third admission July 5 to July 30, 1946. Liver function tests were normal. At operation July 3, 1946, exploratory laparotomy through a left subcostal incision was carried out by one of us (R. R. L.). The splenic vein was found to be too small for an end-to-side anastomosis. An inferior mesenteric to left ovarian vein shunt was performed. A liver biopsy showed normal liver. Initial portal pressure 35 centimeters of saline after the anastomosis 24 centimeters of saline. The convalescence was uneventful. Follow-up. The patient was seen 3 months after the operation and had had no further bleeding episodes from the esophagogastrintestinal tract. A gastrointestinal series in June 1947 revealed the varices to appear unchanged.

This patient it is believed is an example of extrahepatic portal bed block of congenital origin secondary to obliteration of the portal vein. Following a splenectomy and ligation of periesophageal veins she had no bleeding for 4 1/2 years. This case demonstrates that when the spleen has been removed at a previous operation the splenic vein no longer is usable for a splenorenal anastomosis. In this case it was necessary to anastomose the inferior mesenteric vein to the left ovarian vein. The fact that she has not bled for 13 months is encouraging. It would indicate that the shunt is still functioning. It is planned if further bleeding occurs to attempt a portal vein or superior mesenteric vein to inferior vena cava shunt.

CASE 12. F. B. No. 554,060, a 65 year old male dental supply worker was admitted to the Massachusetts General Hospital on October 24, 1946, because of massive hematemesis and melena. Physical examination revealed a man in shock with an enlarged liver and spleen. A gastrointestinal series revealed extensive lower esophageal varices. Laboratory studies after several transfusions revealed hemoglobin 9 grams, serum protein, 6 grams with an albumin-globulin ratio of 2, nonprotein nitrogen, 46 milligrams per cent, prothrombin time 16 seconds with a normal of 14 seconds, bromsulphalein test showed

34 per cent dye retention and a cephalin flocculation test was 1+ in 48 hours. Conservative treatment was instituted for the next 6 weeks and the liver function improved so that the bromsulphalein test showed only 6 per cent retention. At operation, January 11, 1947, a splenectomy and an end-to-side suture type of splenorenal anastomosis was performed by one of us (R. R. L.). The initial portal pressure was 23 centimeters of saline and following the completion of the anastomosis it was 14 centimeters of saline. A liver biopsy showed no definite evidence of underlying liver disease. The patient was discharged on February 1, 1947, 21 days following the operation. Follow-up. On August 8, 1947, he stated that he felt better than he had for several years, had gained 19 pounds, no further bleeding from the esophagogastrintestinal tract.

This patient it is believed is an example of acquired extrahepatic portal bed block secondary to thrombosis in the portal system, treated by splenectomy and an end-to-side splenorenal anastomosis. The liver function tests were normal except for a high retention bromsulphalein but a liver biopsy showed no underlying liver disease. The cause of the portal thrombosis is obscure so it must be classified as spontaneous. Further observation in this case will be necessary to determine the efficacy of the procedure.

CASE 13. M. M. C. No. 560,473, a 44 year old white woman was admitted to the East Medical Service on January 10, 1947, because of massive hematemesis. Physical examination revealed a pale woman, the liver was not palpable and the spleen could just be felt. Laboratory studies disclosed red blood cells 2.0 million, hemoglobin 7 grams, white blood cells 2,700, a bromsulphalein retention test, prothrombin time, cephalin flocculation and albumin-globulin ratio were normal. A gastrointestinal series revealed esophageal varices. A diagnosis of portal hypertension with bleeding esophageal varices due to an extrahepatic portal bed block was made. At operation, February 7, 1947, a splenectomy and an end-to-side suture type of splenorenal anastomosis was performed by one of us (R. R. L.). The initial portal pressure was 34 centimeters of saline and following the anastomosis it was 24 centimeters of saline. She was discharged on February 24, 1947, 17 days after the operation. Follow-up. On August 8, 1947, she stated that she felt fine, had no abdominal pain, no further hematemesis or melena.

This patient it is believed is an example of acquired extrahepatic portal bed block secondary to thrombosis in the portal system. She was treated by splenectomy and end-to-side splenorenal anastomosis. The etiology of the portal thrombosis is obscure so that it must

be classified as spontaneous. The initial portal pressure was 34 centimeters and following the completion of the shunt it was 24 centimeters of saline. This observation in addition to the fact that she is well and has had no further bleeding episodes since the operation for a period of 6 months is encouraging that the shunt is still functioning but further observation will be necessary to evaluate the procedure.

**CASE 14.** M. M. No. 434,339, a 19-year-old white woman, was first admitted to the West Medical Service of the Massachusetts General Hospital on February 4, 1944, because of repeated episodes of hematemesis over a 5-year period. The latest attack began 5 days before admission. The liver was not palpable. The spleen was three fingers below the costal margin. Laboratory studies disclosed red blood cells 4.0 million, hemoglobin 15 grams, white blood cells 6,400, total serum protein 7.38 grams with an albumin-globulin ratio of 1:3, a bromsulphalein test showed 40 per cent retention in 45 minutes, cephalin flocculation showed 4+ in 48 hours, the van den Bergh was normal. A gastrointestinal series showed esophageal varices. A liver biopsy revealed a normal liver. On March 9, 1944, through a transthoracic approach a splenectomy was performed by Richard H. Sweet and several large periesophageal vessels as well as the left gastric vessels were ligated. The patient was discharged April 3, 1944. Second admission, December 12, 1944, to July 11, 1945, admission because of massive hematemesis. Hospitalization was greatly prolonged because of the onset of vague abdominal discomfort and persistent fever. Consensus was that the fever was due to thrombophlebitis in the portal system. At operation, June 25, 1945, a portacaval anastomosis was attempted by one of us (R. R. L.) but was technically impossible because of a cavernomatous transformation of the portal vein. A liver biopsy was normal. Third admission, December 11, 1946, to January 27, 1947, because of massive hematemesis. Liver function studies were normal. At operation, January 10, 1947, through a left abdominal incision the splenic vein was searched for by one of us (R. R. L.) but it could not be found nor was there any other vein suitable for a venous anastomosis. Fourth admission, February 23, to February 28, 1947, was for hematemesis. Fifth admission, March 4, to March 20, 1947, for another attempt at a venous anastomosis. At operation, March 10, 1947, through a thoracoabdominal incision by one of us, (R. R. L.) an anastomosis between the inferior mesenteric vein and a large adrenal vein was accomplished. It was felt that decompression of the portal hypertension was not entirely satisfactory because of the small caliber of the operative anastomosis. Sixth admission, July 25, to August 13, 1947, for hematemesis. Seventh admission, August 15, to September 30, 1947, for hematemesis and another

and final attempt at a venous shunt. At operation, September 10, 1947, another attempt at a direct portacaval anastomosis was made by one of us (R. R. L.) but again no vein including the portal vein could be found to make a satisfactory shunt.

This patient it is believed is an example of extrahepatic portal bed block of congenital origin secondary to obliteration of the portal vein. Her symptoms first appeared at the age of 14 years. She demonstrates the inefficacy of splenectomy with ligation of the left gastric and periesophageal veins in the control of portal hypertension. She also is an example of the difficulty of performing a satisfactory venous shunt operation when the spleen has been previously removed in this type of case due to a cavernomatous transformation of the portal vein which precludes using this vessel. In view of the experiences with this case it is our opinion that any surgeon who removes the spleen in a so-called case of Banti's syndrome should be prepared to perform a splenorenal shunt at the same operation since otherwise at a later time it will be impossible to find a satisfactory vein with which to perform a portacaval shunt.

**CASE 15.** J. S. No. 566,107, a 23-year-old white single male factory worker was admitted to The Baker Memorial Hospital for the first time on February 28, 1947, because of repeated episodes of hematemesis. The patient had been well until 6 years before when he had had a sudden large hematemesis. On the day of admission to the Massachusetts General Hospital he was first seen by Chester M. Jones who immediately admitted him. Physical examination revealed a pale white young man. The liver and spleen could not be palpated. Laboratory studies: hemoglobin 4.9 grams, white blood cells 2,900, serum protein 6.5 grams with an albumin-globulin ratio of 3, prothrombin time 17 seconds with a normal of 16 seconds, cephalin flocculation 1+ in 48 hours, bromsulphalein test 4 per cent retention, a gastrointestinal series showed large esophageal varices. A diagnosis of portal hypertension with bleeding esophageal varices due to extrahepatic portal bed block (Banti's syndrome) was made. At operation, March 13, 1947, a splenectomy and an end-to-side suture type of splenorenal anastomosis were performed by one of us (R. R. L.). The initial portal pressure was 42 centimeters of saline, following the anastomosis it was 23 centimeters of saline. The patient made a good convalescence and was discharged from the hospital 2 weeks after operation. Follow up, August 26, 1947. Patient reported that 5 months after operation he felt well, was back at work, weighed 158 pounds and had had no further evidence of esophagogastrintestinal bleeding.

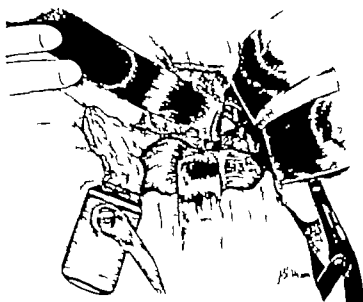


Fig. An artist drawing to show the completed end-to-side splenorenal anastomosis, splenic vein, renal vein, left kidney. The exposure is through thoracoabdominal incision.

This patient it is believed is an example of extrahepatic portal bed block of congenital origin secondary to obliteration of the portal vein who was treated by splenectomy and an end-to-side splenorenal shunt. His first hematemesis occurred at the age of 17 years. He had repeated episodes until the shunt operation which was performed 6 years later. Liver function tests were normal. The initial pressure was 42 centimeters of saline and immediately following the completion of the shunt it was 23 centimeters of saline. This observation and the fact that he was well without further bleeding 5 months later is encouraging but too short a time to be sure that his condition has been completely relieved.

#### DISCUSSION

The shunting of the blood flow to or from a part of the body by blood vessel anastomoses is one of the more recent types of operation that has been perfected in recent years. Since Eck in 1877 first successfully performed a direct portacaval shunt in experimental animals, numerous investigations have been carried out in the laboratory to determine the

effect produced on the nutrition by such a procedure. Some of the most recent work has been reported by Whipple and his co-workers (21) in 1945. They concluded from experimental studies on dogs with a complete portacaval shunt so that only the blood from the hepatic artery reached the liver that there were slight gross and histological changes in the liver. At times they noted in their animals, evidence of some functional abnormalities of the liver. A dog properly fed was found to tolerate such a shunt for 1 to 8 years and appear normal. Whipple (20) and Blake-more (2) have reported the successful production of similar portacaval shunts in human patients with apparent benefit of the portal hypertension and general improvement of the patients' condition but the effect on these individuals over a long period of time is awaited with much interest.

In our clinic some other type of shunt has been considered more desirable for two reasons. First the experimental evidence on animals, which of course is not conclusive for humans, indicates that there is some disturbance of liver metabolism. It seems advisable

to us if possible to produce some form of shunt which will not cause all the portal blood to bypass the liver. Since there are no valves in the portal vein or its tributaries it is possible to reverse the flow of blood in them. For this reason various types of venous shunts can be performed as demonstrated in this report. The second reason the direct portacaval anastomosis is not preferred is a practical one. In a number of our patients it has been impossible to isolate the portal vein because of the extreme vascularity in the region of it. For example, in Cases 4, 10, and 14 search for the portal vein had to be discontinued because of extensive hemorrhage. One of these patients, Case 4, even died as the result of the exploratory procedure. In Case 10 the common and cystic ducts were divided necessitating a cholecystectomy and a choledochojunostomy performed according to the method described by Allen. In another patient, Case 3, although the anastomosis was completed the hepatic artery was apparently damaged and as a result death followed secondary to thrombosis of the hepatic artery. On theoretical grounds and as a result of these practical experiences, namely the inability to perform a direct portacaval anastomosis in a number of cases and the danger of injury to such structures as the hepatic artery and the common bile duct, it seems to us that some other shunt is preferable if it will reduce the portal hypertension.

The operation of choice for portal hypertension whenever possible in our opinion at the present time should be a splenectomy with an end-to-side splenorenal anastomosis with preservation of the kidney (Fig. 2). Cases will be encountered in which this will not be possible such as in patients who have had a previous splenectomy and rarely in a patient with splenic vein thrombosis in whom splenectomy alone will suffice. There are a number of reasons worth enumerating why the above type of procedure is preferred. First it produces a partial shunt of the portal blood flow so that the liver is not completely bypassed. Second from our observations this type of shunt appears to lower satisfactorily the portal hypertension. Third splenectomy reduces the arterial inflow to the portal area by approximately 40 per cent and thereby aids in reduc-

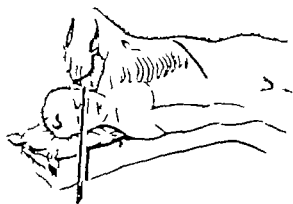


Fig. 3. An artist's drawing to show the position of the patient on the operating table. The line of incision is shown. It is at and through the bed of the tenth rib forward to the mid line of the abdomen just above the umbilicus.

ing the portal hypertension. Fourth removal of the organ also divides many of the collateral channels which feed the esophageal varices so that the venous pressure and the blood flow through them will be diminished. Fifth there are no vital structures in the left upper quadrant of the abdomen, the region through which the surgical approach is made for this type of shunt, similar to the common bile duct and the hepatic artery, which lie in such close proximity to the region of the portacaval anastomosis. This point is of great practical importance since in either type of shunt operation structures are obscured by bleeding from innumerable small collateral venous channels. An error of a few millimeters in the region of the gastrohepatic ligament while searching for the portal vein may result in a fatality or prevent the successful construction of the anastomosis, whereas in the splenic area one at least has the peace of mind that such a catastrophe is less likely to occur as the margin of safety in this region can be measured in centimeters rather than millimeters. The practical value of the thoracoabdominal approach (Fig. 3) cannot be overemphasized in the exposure of the spleen, the kidney and their vessels.

Another advantage of the end-to-side type of splenorenal anastomosis is that the left kidney is not sacrificed. It is recognized that a single kidney is sufficient for the bodily needs under normal conditions, but in patients as critically ill as some of the portal hypertension cases it seems to us advisable to save this organ rather than sacrifice it. That this may

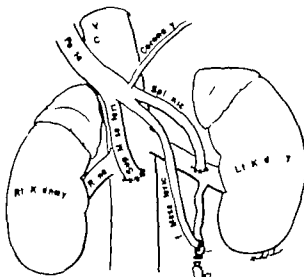


Fig. 4. An artist's drawing to show the portacaval shunt utilized. The splenoportal end-to-side anastomosis is preferred, but in cases that had had previous splenectomies, Cases 8 and 9, superior mesenteric to inferior vena cava and an inferior mesenteric to left ovarian anastomoses have been used respectively with apparent relief of the portal hypertension.

be of considerable practical importance in operations of the magnitude of these is demonstrated by Case 10. Even with two kidneys the nonprotein nitrogen level rose from 15 milligrams per cent to 102 on the sixth postoperative day and despite an adequate fluid intake the renal output was only 400 to 500 cubic centimeters for several days. The blood chemistry and urine volume returned to normal levels after the second postoperative week. This patient it can be readily seen was so close to renal failure following this operation that it certainly is within the realm of possibility that if his left kidney had been sacrificed he would not have survived.

The end-to-side type of anastomosis in addition to preserving the kidney we believe has the advantage that it is less apt to become thrombosed. This opinion was based chiefly on the fact that the flow of blood in the renal vein might have a sucking effect at the site of anastomosis, thus lessening the possibility of thrombosis. The results of the recent experimental work by Johns and by Blalock (5) lend support to this opinion as they found utilizing the suture method of anastomosis that the incidence of thrombosis was 10 per cent in the end-to-side type while with the end-to-end it

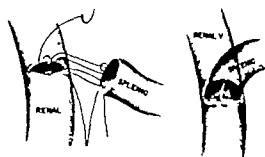


Fig. 5. An artist's drawing to show the method of suturing the end of the splenic vein to the side of the renal vein. Suture 1 is a stay suture and suture 2 is a running mattress type placed to evert the edges. It is tied to additional stay sutures at other points in the circumference of the anastomosis to prevent a pinching effect.

was 27.3 per cent. The suture method of anastomosis described by Blalock (6) is preferred to the nonsuture technique of Blakemore and Lord (3) utilizing the vitallium tubes, since there is less danger of thrombosis with the former. Blalock (5) and Johns performed a comparable series of end-to-end splenoportal anastomoses in animals with the two methods. They reported an incidence of thrombosis of 27.3 per cent in the suture group and 72.8 per cent in the nonsuture group. These facts seem significant and perhaps are due in part to the fact that a large foreign body is left in close proximity to the vein wall. Another reason may be that it is not necessary to dissect free as much of the splenic vein with the suture method as with the nonsuture method. For this reason the vasa vasorum of the vein wall are less disturbed. This tends to protect the intima from degeneration which if it occurs favors thrombosis as pointed out by O'Neill. Up to the present time none of our cases has become thrombosed as far as is known. The anastomoses in the 4 patients who died were all patent. They survived such a short time however following the operation, one cannot be sure they would have remained open indefinitely. However the absence of further esophagogastrintestinal bleeding in the surviving patients with the exception of Case 14 is encouraging. The technique of suturing the veins together is similar to that described by Blalock (6) for the arterial shunt operations in the treatment of the tetralogy of Fallot. Care

TABLE II.—RESULTS IN THE TREATMENT OF PORTAL HYPERTENSION WITH SHUNT OPERATIONS  
MASSACHUSETTS GENERAL HOSPITAL 1945-1947

## Intrahepatic Type

Case No	Age Sex	Type of shunt operation	Date of operation	Postoperative period with out bleeding	Varices still present by ray	End result & date
1	45 F	Splenectomy nephrectomy end-to-end splenoportal	3 6 45	20 mos	Yes	Alive
2	45 M	Superior mesenteric to inferior vena cava	45	—	—	Dead
3	55 M	Portal vein to inferior vena cava	8-46	—	—	Dead
4	42 M	Portal vein to inferior vena cava (attempted)	8 9-46	—	—	Dead
5	52 M	Splenectomy end-to-side splenoportal	9-46	—	—	Dead
6	54 M	Splenectomy end-to-side splenoportal	4 7 47	—	—	Dead
7	51 M	Splenectomy, end-to-side splenoportal	6 1 47	10 mos	Yes	Alive

## Extrahepatic type

8	28 M	Superior mesenteric to inferior vena cava	9 9 47	10 mos	Yes	Alive
9	6 F	Splenectomy end-to-side splenoportal	6 4 46	4 mos	Yes	Alive
10	30 M	Splenectomy end-to-side splenoportal	6-8 46	4 mos	Yes	Alive
11	20 F	Inferior mesenteric to left ovarian vein	7 3 46	13 mos	Yes	Alive
12	65 M	Splenectomy end-to-side splenoportal	47	7 mos	N t checked	Alive
13	45 F	Splenectomy end-to-side splenoportal	7 47	6 mos	N t checked	Alive
14	F	Inferior mesenteric to left adrenal vein	3 9 47	Bled 4 mos	Yes	Alive
15	3 M	Splenectomy end-to-side splenoportal	3- 1 47	5 mos	Not checked	Alive

must be taken not to narrow the anastomotic opening by drawing the continuous suture too tightly. Interruption of it at three points in the circumference of the anastomosis is advised to prevent too much of a pursestring effect. The suture is placed so that the edges are everted and an intima-to-intima approximation is obtained. A No 00000 braided silk suture on a No 9 curved atraumatic type of needle is used (Fig 5). A detailed description of the complete operative procedure has been published recently by one of us (12).

The function of the left kidney as shown by intravenous pyelography has not been damaged by the procedure. The renal artery was occluded for periods of 18 to 35 minutes as a rule while performing the splenoportal anastomosis. Occlusion of this vessel may not be necessary but it seemed best to do it and so avoid a high degree of back pressure on the renal vascular system.

The results obtained in the group of patients with extrahepatic portal bed block have been more satisfactory than in the intrahepatic group (Table II). In the former 7 patients out of 8 have not bled since the shunt was performed over periods varying from 5 to 22

months. Five of these patients had splenectomy with an end-to-side suture type of splenoportal shunt with no bleeding for 5 to 14 months. The 3 others had had previous splenectomies so that in them the following anastomoses were performed respectively: (1) superior mesenteric vein to inferior vena cava with no bleeding for 22 months; (2) inferior mesenteric vein to left ovarian vein with no bleeding for 13 months; (3) inferior mesenteric vein to left adrenal vein with bleeding again after 4 months. The results in these cases are encouraging except in the last one. The veins used in this case were so small it was thought they probably would thrombose as apparently has happened. The fact a previous splenectomy had been performed on this patient may eventually result in her death since it now seems impossible to perform a satisfactory shunt. There were no deaths in this group so the operative mortality was zero per cent.

The results were not as satisfactory in the intrahepatic group (Table II). Only 2 of the 7 patients survived making a mortality rate of 71 per cent. One of the surviving patients, Case 1, has been 29 months without bleeding the longest period of both groups. She was



operated on by Richard H Sweet and an end-to-end nonsuture vitallium tube anastomosis was performed. The other surviving patient Case 7 has been done only a period of 3 months. The deaths in the other patients of this group it is believed can be best explained by the fact that all of them Cases 2, 3, 4, 5 and 6 were extremely ill patients prior to operation. All had extremely sick livers. They all were prepared as thoroughly as possible but because of their severe liver disease they could not withstand such long surgical procedures. Two of them Cases 4 and 7 succumbed from postoperative hemorrhage in part due to the citrate solution used in the blood transfusions. It is believed that patients with such severe liver disease are unable to metabolize sodium citrate as well as the ones with normal livers. All of them except Case 6 were treated conservatively for several years for repeated esophagogastrintestinal hemorrhages, so that when the shunt operations were performed the general condition of them was extremely poor. It would seem advisable, therefore in view of the good results obtained in the younger group with extrahepatic block and also in the two cirrhotics, Cases 1 and 7 who were in good condition that a splenectomy and an end to-side splenorenal shunt should be recommended before the patient becomes depleted from multiple hemorrhages.

#### CONCLUSIONS

1 The development of the portacaval shunt type of operation represents a new chapter in the treatment of portal hypertension. It apparently prevents serious hemorrhage from esophageal varices, although they may still persist by roentgenographic examination and in addition may improve the liver function. Further observation of the cases reported is necessary to determine the true value of the procedure.

2 Splenectomy and the suture type of end-

to-side splenorenal anastomosis with preservation of the kidney performed through a thoracoabdominal incision are recommended as the most satisfactory operative procedure in cases, especially for extrahepatic portal bed block in which the spleen has not been previously removed.

3 Anastomosis of the superior mesenteric vein to the inferior vena cava and of the inferior mesenteric vein to the left ovarian vein has been utilized with apparent success, in 2 patients who had had the spleen previously removed.

4 Direct anastomosis of the portal vein to the inferior vena cava may frequently be impossible due to the extreme degree of vascularity in the region of the gastrohepatic ligament.

5 The results in 15 patients treated by various types of portacaval shunts have been more satisfactory in extrahepatic portal bed block than in the intrahepatic type.

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## CHILDBEARING IN THE TWILIGHT OF THE REPRODUCTIVE PERIOD

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**A**GING is a universal phenomenon of all life. No sooner is one born than he or she begins to age. Individuals grow old at varying rates some rapidly and others more slowly. Disease of vital structures hastens the process of aging. In the last decade the profession has become acutely interested in old age for the ever increasing length of life has suddenly thrust upon us the problems of the elderly. The specialty of geriatrics has many new devotees. However one of these new specialists so aptly defined this newest problem as beginning at birth and ending at the grave.

The reproductive function unlike the other physiologic functions begins in the middle teens and ends in the fifth decade. There are few authentic records of childbirth in the fifties. In over 50 000 deliveries at the Chicago Lying in Hospital only 2 women of 46 and 2 of 48 gave birth to children. Reproduction in the human race has been limited by nature to the first half of the life cycle thereby emphasizing the fact that it is a function of youth and not middle age. Much has been written about pregnancy and labor in the elderly primipara the woman over 30 or 35 years old. However little has appeared in the literature about reproduction in women 40 years old and older. There was a classic contribution by Bethel Solomons many years ago entitled 'The Dangerous Multipara' in which he emphasized the hazards of pregnancy and delivery in women who had many babies. However this study was prompted by the frequent question raised by patients "I am nearly 40 years old. Do you think it is safe for me to have a baby, or as the case may be, "another baby for my family has grown up and I would like another child to raise?" These are pertinent questions and physicians are expected to know the answers.

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In an attempt to answer them intelligently the authors decided to study the pregnancies labors and recovery periods of 1 000 women 40 years and older delivered at the Chicago Lying in Hospital and to compare these with the hospital statistics covering all deliveries during this same period wherever possible. In order to study 1 000 consecutive pregnancies in women 40 and over it was necessary to include the years 1927 to 1944. The study comprises 1 011 patients in this category. During this same period we delivered a total of 52 128 women at the hospital. The incidence of pregnancies in women 40 years and older is 1.94 per cent. Most of these 841 or 83.2 per cent were multiparas and only 16.8 per cent primiparas. An interval of at least 10 years had elapsed since the last baby was born in 152 multigravidas 18 per cent of this entire group.

In a study of this type it is necessary to present many statistical tables. These may be valuable for those individuals who have a special interest in the problem. However for most readers who find statistical studies laborious to digest we will draw a few interesting conclusions from these data.

In Table I it will be seen that 50 of the pregnancies ended in abortions an incidence of 4.9 per cent. This is higher than the hospital incidence although neither figure is representative of the population at large. In all likelihood all women with spontaneous abortions do not enter hospitals. In many instances they may not be aware of an early abortion for it may manifest itself only in an irregularity of the menstrual function. Such irregularities are rather common at this time of life. Few induced abortions enter the Chicago Lying in Hospital so that the incidence of criminal abortions at this age period cannot be gleaned from our data. All that can be concluded is that spontaneous abortions are more frequent in women of 40 and over than in the general hospital group.

TABLE I — TOTAL DELIVERIES 1927-1944

	Women 40+ years						Hospital
	Primiparas		Multiparas		Total		
	N	Per cent	N	Per cent	N	Per cent	
Pregnancies	70	16.8	841	83	101	94	3.178
Births	64	7	706	8	960	64	8%
Abortions	3	3	43	9	46	9	0%
Ectopic		6					26%
Infant mortality	12	9.3	77	9.8	89	9.3	3.5%
Neonatal	7	4.8		3	18	0	7%
Maternal mortality				2	4	42	7%

It is of interest that only 1 ectopic occurred in this group and that 1 in a primipara. The low incidence of tubal pregnancy may mean that if complete tubal occlusion is not present a pregnancy will occur earlier in life

## PREGNANCY

The complications of pregnancy are listed in Table II. As we might expect the most frequent complications in women 40 years and older concern the vascular renal system. Aging manifests itself first in the circulatory organs and the old adage that "you are as old as your arteries" has more than a grain of truth. Circulatory diseases exclusive of the toxemias of pregnancy were three times as common as in the general hospital group 13.4 per cent compared to 4.6 per cent. This group includes heart disease, thrombophlebitis and phlebotrombosis, extensive varicosities, productive

TABLE II — COMPLICATIONS OF PREGNANCY

Women 40+ years							Hospital Percent
	Primiparas		Multiparas		Total		
	No	Per cent	No	Per cent	No	Per cent	
Circulatory exclusive of toxemias	13	7.7	5	13	9	13	6
Ascaris	9	1.3	33	9	42		3.8
Pulmonary	5		8		13		
Nervous system			6	7	6	7	
Gastrointestinal		6	26	3	27	3	5
Endocrine	6	6	7		13		3
Other		6	8	9			

TABLE III. — TOXEMIAS OF PREGNANCY

Women 40+ years							Hospital (1927-1944)
	Primiparas		Multiparas		Total		Per cent
	No.	Per cent	No.	Per cent	No.	Per cent	
Hypertensive disease benign							
Mild	3	4.7	97	5	100	10	3.7
Severe			16	0	16		
Renal disease							
Chronic vascular nephritis			26	3.3	26	3	5
Glomerulonephritis		6					
Pre-eclampsia							
Mild	24	24	79	3	94	9	7
Severe		6			3	3	
Total					127	24	7

of marked symptoms and miscellaneous less common conditions. There was an increase in gastrointestinal complications in the women 40 years and older although interestingly enough, these were almost entirely confined to the multipara. These complications likewise increase in frequency with aging so that pregnancy probably contributed little to this increase.

The toxemias of pregnancy are directly or indirectly the result of gestation. In Table III it will be seen that the total incidence of these pregnancy complications was 24 per cent in women 40 years and older whereas the general hospital incidence is 7.1 per cent. Thus, the elderly gravida has three and one-half times the hazard of developing a toxemia of pregnancy than the average patient.

Pre-eclampsia and eclampsia are the true toxemias of pregnancy in the sense that they are caused by the pregnancy. Aging must be an important predisposing cause for the development of this pregnancy toxemia for the incidence in the group of elderly patients is three times that in the hospital group. The typical pre-eclamptic is a woman who has a normal blood pressure and kidney function prior to the onset of pregnancy. Sometime in the last trimester of pregnancy she develops fluid retention and excessive weight gain, hyperten-

TABLE IV — PLACENTA PREVIA

	Women 40+ years				Hospital (93-1945)			
	Incidence 28-4.9 per cent				2.3-0.70 per cent			
	Primiparas		Multiparas		Primiparas		Multiparas	
	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
Incomplete	3	8			68	36	160	73
Complete			6	0.37	14	7	74	33
Total	4	9.4	6	0.7	82	43	234	106
Total deliveries	65	7	706	8	86	0.5	34	4.5

sion and albuminuria. She usually is a nulli gravida. However most of these patients were multiparous women. We must assume that aging conditions the vascular renal system so that it is more vulnerable for whatever the etiologic agent or set of circumstances which induce pre-eclampsia and eclampsia.

Hypertensive and vascular renal disease is a manifestation of aging. Pregnancy influences these conditions adversely. In the multipara each pregnancy may add to the residual damage so that childbearing may add a considerable hazard in the woman who has reached middle life. Abruptio placentae, intrauterine death of the fetus, failure of normal fetal growth and kidney failure are all undesirable sequelae.

Placenta previa is essentially a complication of the last trimester of pregnancy. It represents the implantation of the fertilized ovum in an abnormal site within the uterine cavity. At first glance it would appear that aging should not influence the incidence of this complication. However clinical experience has brought out the fact that multiparity increases the frequency in direct proportion to the number of births. How pregnancies alter the transport mechanism of the fertilized ovum or the uterine environment to favor implantation near the cervical os is not known. However the incidence of placenta previa was 2.9 per cent in women 40 and older, four times the hospital incidence of 0.79 per cent. These occurred predominantly in multigravidas (Table IV).

The high incidence of hypertensive and vascular renal diseases in women 40 and over would predispose to an increased incidence of

TABLE V — ABRUPTIO PLACENTAE

Women 40+ years				Hospital (93-1945)			
Total incidence 2.1 in 45 deliveries per cent				in deliveries 0.83 per cent			
Primiparas		Multiparas		Primiparas		Multiparas	
No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
4	4.2	6		66	26	27	73.9

abruptio placentae. The incidence of 2.1 per cent was almost three times the hospital incidence of 0.83 per cent (Table V).

### LABOR

Labor terminated uneventfully in the majority of women 40 years and older and the incidence compared favorably with our hospital statistics. At least half of the primigravidas delivered spontaneously or were delivered by simple low forceps. Age alone should not be considered as the motivating factor in deciding against a normal delivery. However the woman having her first baby at the end of her reproductive period must be given intelligent care. Often it is her only opportunity for a child. Furthermore the incidence of the complications of pregnancy, the toxemias, placenta previa, and abruptio placentae are all increased so that they must enter into the choice of the best method for delivery. Thus it is not age alone but age plus these complications of pregnancy occurring with greater frequency because of age that determines the

TABLE VI — TERMINATION OF PREGNANCY

Women 40+ years							Hospital
	Primiparas		Multiparas		Total		( 93 p46)
	No.	Per cent	No.	Per cent	No.	Per cent	
Spontaneous	37	6.4	540	68	577	59	36
Forceps	76	45	107	14	183	9	33
Low	1	30.8	60	8.7	61	3	20
Mid	5	5	38	4.7	43	6.6	4
Cesarean section	3	3.5	76	9.5	79	13.3	4.4
Breech extraction	6	3.6	3	3.9	9	3.8	4.4
Twins		6	1			1	1
Version and extraction		6	35	3.1	41	7	9
Other		0.6	7	9	8	8	0.7

TABLE VII.—INDICATIONS FOR CESAREAN SECTION

Women 40+ years					Hospital
	Primiparas	Multi- paras	Total		( 1917- 1947) Per cent
			N	Per cent	
Dystocia Disproportion	26	13	39	39.4	3
Toxemia		3	5	39.5	5
Hemorrhage	6	10	16	12.3	10.8
Cardiac	4	3	7	3.3	
Other	4	7		8.8	

mode of delivery. It is not surprising therefore that 31.5 per cent of primiparas were delivered by cesarean section whereas the hospital incidence is 4.4 per cent (Table VI).

The incidence of cesarean section in multiparous women was likewise increased 9.5 per cent. This increase resulted from several factors. First and foremost was the marked increase in the complications of pregnancy particularly the toxemias. Many of these patients were delivered prior to the end of pregnancy in order to halt the progress of the disease or to increase the likelihood of a living child. In some of these women abdominal delivery in addition afforded an opportunity to terminate the reproductive career. However this has not been the primary objective of cesarean section in the last 7 or 8 years. Placenta previa and abruptio placentae may be better treated by abdominal delivery than by other methods. The elderly multipara occasionally not often develops an abnormal labor mechanism, a faulty fetal position, or the size of the baby exceeds the capacity of the pelvis. Cesarean section may offer the most conservative termination in some of these circumstances. It will be noted in Table VI that the incidence of version and extraction was likewise increased as a result of some of these factors.

Table VII lists the indications for cesarean section and it can be seen that the percentage of cesarean sections done for the major complications did not differ much in the two groups. Although 32 per cent of our abdominal deliveries are for cephalopelvic disproportion and dystocia, 30.4 per cent of the sections

TABLE VIII.—INCIDENCE OF CESAREAN SECTION

Women 40+ years	Total 18-43 32 per cent		Hospital (1917-1947) Per cent
	No.	Per cent	
First section	26	78.5	61
Second section	23	27	11.4
Third section	5	3.9	3
Fourth section	3		
Maternal mortality		3	66
Cesarean hysterectomy	26	30.3	7.4
Vaginal cesarean section		3	3

in the group of women 40 years and older were done for this indication. There is a slightly higher incidence in the other complications listed because of the increased incidence of these conditions. This statistical table emphasizes the fact that age alone was not the primary factor in the choice of abdominal delivery but it contributed in the ultimate decision.

A breakdown of the abdominal deliveries is presented in Table VIII. The high incidence of cesarean hysterectomies is noteworthy. There were three times as many cesarean hysterectomies in women 40 years and older, 30.3 per cent as in the general hospital group, 7.4 per cent. This can be accounted for by the increased frequency of neoplasms at this period of life, the increase in pregnancy complications such as abruptio placentae and placenta previa, as well as the decreased value of the uterus at the end of the reproductive period. The choice of cesarean hysterectomy as a means of abdominal delivery in women late in life in whom reproduction is no longer possible or desirable has been made more and more frequently on our service at the Chicago Lying In Hospital. It is an excellent elective procedure and when done properly does not increase the risk of abdominal delivery. The patient is relieved of many of the complications associated with the menopause. The fear of cancer of the corpus is likewise removed. It is a procedure which should find increased use by specialists.

The duration of labor in women who were delivered vaginally was approximately the same in both groups of patients (Table IX). If the length of labor is to be used as a guide, aging did not alter the course of natural labor. The multigravida of 40 years and older did not

TABLE IX.—DURATION OF LABOR

Women 40+ years							Hospital Percent
	Primiparas		Multiparas		Total		
	N	Per cent	N	Per cent	No.	Per cent	
	Less hrs.		Less 5 hrs.				
Short	46	25.0	70	23.8	75	23.0	27
	0-4 hrs.		5-10 hrs.				
Average	48	40.6	400	60.5	457	55	54.5
	11 hrs. +		10 hrs. +				
Long	24	20.5	48	7.7	7	8.6	8.9

have a longer labor than her younger sister. There were however many more complicated labors in the older group of mothers for in Table VI it will be noted that whereas the incidence of mid forceps is 4.0 per cent in our hospital 15.2 per cent of the primiparas were delivered by mid forceps operations. These procedures were indicated largely because of failures in the labor mechanism. The occiput failed to rotate anteriorly resulting in a transverse arrest of the head or an occiput posterior position the forces of labor were unable to bring the head onto the perineum or the soft parts were abnormally rigid. These labor complications can be charged directly to the age of the woman having her first baby.

One observation that is difficult to explain is the increase in breech presentation in the group of elderly women. The incidence of breech in the primiparas was 7.4 per cent and the multiparas 5.4 per cent in contrast to the hospital figure of 4.4 per cent. There was an increase in the transverse presentations among the multiparas which was to be expected 1.1 per cent compared with a hospital incidence of only 0.2 per cent.

#### PLACENTAL STAGE OF LABOR

The placental stage of labor was marked by an abnormal blood loss in a greater number of women 40 years and older than in the hospital group as a whole. The incidence of postpartum hemorrhage was 3 per cent in the primiparas and 7.1 per cent in the multiparas whereas the hospital average during this entire period was 7.7 per cent. It is not surprising that more of the multiparas had an excessive blood loss

TABLE X.—WEIGHTS OF BABIES

Women 40+ years							Hospital
Birth weight grams	Primiparas		Multiparas		Total		
	N	Per cent	N	Per cent	N	Per cent	
	Less than 1000		1000-1500		1500-2000		
Less than 1000							7
1000-1500	4	4	3	6	17	7	0.8
1500-2000	27	6	66	8	93	9.6	6
2000-2500	85	5	365	44	450	45.7	50.8
2500-3000	40	24		7	26	26.5	7.9
3000-3500	9	5.4	97		106	8	6.5
3500-4000		6	26	4.4	32	3.8	
4000+			9	9	9	9	

for difficult labors and operative interventions increase the hazard of uterine atony. Many of these patients were delivered prior to the use of ergonovine administered intravenously at the end of the second stage of labor. There has been a phenomenal decrease of excessive blood loss during the placental stage since the introduction of present day management of this important phase of delivery.

#### THE INFANT

In Table X there is a comparison of the birth weights of babies born to mothers 40 years and older and the entire hospital group. In general it can be said that there are no significant differences in the two groups. It has been observed in one of our previous studies that babies tend to become progressively larger in each pregnancy until the fourth baby is delivered following which the birth weight tends to level off. This observation is confirmed in this study for 12 per cent of elderly multiparas gave birth to babies weighing from 4,000 to 4,500 grams and 5.5 per cent weighed more than 4,500 grams. This is more than twice the incidence of babies weighing over 4,000 grams born to all mothers at the hospital.

Table XI is an analysis of the fetal mortality in the various weight groups. There is an increased number of premature babies weighing 1,500 to 2,500 grams in the group of women 40 years and older 9.6 per cent in contrast to a comparable hospital incidence of 6.1 per cent. There is likewise a higher fetal mortality in this same group 200 per 1,000 live birth in

TABLE VI.—INFANT MORTALITY IN RELATION TO BIRTH WEIGHT AND HOSPITAL STATISTICS

Birth weight in grams	Women 20-39 years		Hospital per cent	Women 40-49 years		Women 50+ years		Hospital rate per 1000
	Total births			Stillbirths N	Neonatal deaths No	Total No	Rate per 1000	
	No	Per cent						
Preveuable 400-900			7	2			900	944
Premature	19	3	8.9	5	9	44	400	123
400-1,400		7	8		8	17	2000	2.01
1,500-2,000				7	7	14		
2,000-2,400	93	9.6	6	9		3	190	36
Total	26	27.6	9.1	26	2	28	4	3
3,000-3,900				6	3	9		
4,000-4,400	430	45.6	26.8			14	5	16
4,500-4,900								
5,000-5,900	26	27.6	27	3	3	6	3	6
6,000-6,400	26	27.6	6	3		3	26	3
6,500-6,900	26	27.6	7				27	14
Total	974	100	200	6	20	90	91	11

comparison to the hospital average of 158. This is easy to account for in the increased incidence of maternal complications among the mothers. The extremely high incidence of the toxemias of pregnancy 24 per cent, the increased incidence of complications of the last trimester associated with hemorrhage, and the circulatory disturbances all provide great hazards for the babies. Premature deliveries necessitated by these maternal complications resulted in many premature babies which were normal but did not survive because of their prematurity. Some of them succumbed as a result of the damage they incurred because of the maternal complication.

Babies weighing over 2 500 grams likewise fared less well in the group of elderly women

than in the general hospital group the rate was 42 in contrast to 13 per thousand live births. For the entire group the rate was 91 in comparison to the hospital rate of 35 per thousand live births. The mother 40 years or older who is having a baby has a 1 out of 10 chance of leaving the hospital without a baby. This high fetal loss is worth considering in evaluating obstetrical problems of elderly women.

Women nearing the end of their reproductive periods often inquire as to the possibility of an abnormal baby. Penrose in the *Journal of Mental Sciences* reported that the mean age of the mothers of 224 Mongolian babies was 37.4 years. Furthermore, the probability that a mother will give birth to a Mongolian child is more than doubled for every 5 years after the age of 25. He noted an excess of Mongolians in primigravidae and in multigravidae after their seventh birth. In our material there were 6 Mongolian babies diagnosed while in the hospital. It is more than likely that if a careful follow up were instituted this number may be doubled for a diagnosis may be difficult or impossible during the first 10 days of life. It is of interest to note that they were divided equally between primiparas and multiparas although in our series the former comprised only one fifth of the total number.

Other anomalies of the fetus were more numerous in women 40 years and over. Two babies

TABLE VII.—MORBIDITY

Women 40+ years							Hospital
	Primiparas		Multiparas		Total		
	No	Per cent	N	Per cent	No	Per cent	
Ectometria	9	55	20	5	29	3	3.4
Thrombophlebitis		0	7	9	8	2	
Ptychitis	4	4		3	7	0	
Inf. epiglottomy		6					
Mastitis		6					2
Other		7	9	4	16	2	

TABLE VIII—MATERNAL DEATHS IN WOMEN 40+ YEARS

Unit number	Age, gravida, and para	Disease	Weeks gestation	Termination of pregnancy	Complications
67047 928	Age 43 G. I P. V	Hypertension asthma	4	Spontaneous delivery 30-43 labor Living infant 35 g grams	I testinal obstruction laparotomy 2th day p.p. Died 2th day p.p. Cardiac + pulmon. complication
69138 1979	Age 43 G. III P. III	Mitral heart	40+	1 labor: high forceps failed & F. Rupture of uterus Hysterectomy stillbirth, 4330 gm	Died 1st day p.p.
8 416 930	Age 43 G. I P.	Hypertension abruptio placenta	36	Low stillbirth Classical C S 4330 gm	Died 3 1/2 hrs p.o.
85 8 931	Age 43 G. I P. 0	Dwarf Pott disease	40	Cesarean hysterectomy after test of labor 6 1/2 hrs Living infant, 26 g grams	Shock p. Died 8th p.o. day Peritonitis

had spina bifida malformations 3 had major gastrointestinal anomalies and 16 had a variety of malformations, some major and some minor. There were a total of 27 babies with malformations of one type or another an incidence of 2.7 per cent compared with our hospital incidence of 1 per cent. The increased hazard of a congenital anomaly in the baby cannot be dismissed lightly in women of 40 and older.

#### MATERNAL MORBIDITY AND MORTALITY

The maternal morbidity in the group of women 40 years old and older was comparable to the entire hospital group (Table VII). Tremendous changes have taken place in obstetrics during the 17 years covered by this study so that comparisons are difficult to make. However, no unusual puerperal complications can be ascribed to this special group of women.

There were 4 maternal deaths in the group of women reported in this study. All of these deaths occurred prior to 1931. A summary of the histories is presented in Table VIII. The senior author has recently reviewed the maternal mortality in the Chicago Lying in Hospital. By our own criteria at least 3 of the 4 deaths were preventable by present day standards. The more intelligent obstetrical management of obstetric patients, the increased safety of cesarean section and the use of antibiotics have decreased maternal mortality phenomenally in recent years. In the country at large but especially in the well conducted maternities maternal mortality is decreasing year by year. We can learn nothing from these 4 deaths for they are one milestone in obstetric progress. They need not happen in 1947.

#### CONCLUSION

This study comprises a review of the obstetrical histories of 1,011 women 40 years old and older who were cared for at the Chicago Lying in Hospital during the years 1927 to 1944 inclusive. It was designed to determine how aging can influence the reproductive function. The complications of pregnancy were much more common in this special group of patients than in the general population of the hospital. One out of every 4 women developed a toxemia of pregnancy. Placenta previa and abruptio placentae increased materially. The circulatory complications other than the toxemias much more common in middle age than in the young increased the hazard of childbearing. Labor was marked by a marked increase in operative interventions as a result of the pregnancy complications and the age of the group.

Babies born to women 40 years old and older shared in the greatly increased hazards of childbearing. One out of every 10 mothers failed to take a baby home with her when she left the hospital. The high fetal mortality was the result of an increased number of premature babies, an increased number of congenital abnormalities and a higher incidence of fetal damage because of the greatly increased number of pregnancy complications.

Nothing has been said about the postdelivery recovery of these women and their babies. It was difficult to glean accurate information about many phases of this important period of childbearing. It has been our experience that elderly women recover more slowly than younger ones. They are more likely to have



minor complaints such as residual backache. However the opposite is likewise true. We have all seen women who have acquired the physical and mental attributes of middle age transformed into young women by childbirth with the zest and sparkle that is youth.

The babies of women of 40 and over deserve more study. The adjustment of the mother to the newborn is usually more difficult in older women. The youngster takes to her baby naturally. They grow up together. This relationship must result in a good psychological background for the growing child. The problems of child care appear very differently to the mother of 20 and to the one of 40. These mother and child relationships are very much in the limelight today.

We have not been able to evaluate the real damage to the mother who develops serious complications of pregnancy and labor. Do the toxemias cause irreversible pathology that may handicap or shorten the mother's life? Does pregnancy hasten the inevitable progress of some of the circulatory diseases? These and other questions are very important particularly in the multiparous woman with children who need their mother to help them grow up normally and happily. These are important questions that should be answered in a study of childbearing late in life.

We can conclude from our study that many hazards beset the woman and her baby when childbirth takes place at the end of the reproductive period. These hazards are real and result in increased morbidity and mortality for both. Aging involves primarily those organs which play a vital rôle in reproduction: the vascular system, the heart and the kidneys. Pregnancy adds to the strain placed upon these structures. Indeed we can once more reiterate a pertinent conclusion reached by Eastman that youth is the mother's best ally.

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# CARCINOMA OF THE LIP

## A Review of 563 Case Records of Carcinoma of the Lip at the Pondville Hospital

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**C**ARCINOMA of the lip one of the most malignant neoplasms of the oral cavity is one of the most readily curable malignancies encountered in the body. Because of the prominent location it is usually brought to the attention of the patient at an early stage and therefore should be seen by the physician while still amenable to treatment. This study was undertaken in an effort to evaluate the results of treatment of all patients with carcinoma of the lip either seen in the Out Patient Clinic or admitted to the Pondville Hospital from the time of its establishment in June 1927 to December 1941. This particular period of time was chosen in order to have a complete 5 year follow up record on all the patients who received treatment.

The records of 563 patients with carcinoma of the lip constituted the series for review and consideration. These cases were 2.9 per cent of the 19,664 new patients examined in the Out Patient Department during the period covered by the study.

It was hoped that by a critical study of a relatively large series of cases certain criteria could be established from which it would be possible to outline the method of therapy most likely to be successful in a given case and to give a reasonably accurate prognosis at the outset of treatment.

### ETIOLOGY

The age of the patients at the onset of the disease ranged from 25 to 91 years with the greatest incidence between 55 and 75 years. Both the median age and the mean age were found to be 62 years.

Ninety-eight per cent of the patients were males and 2 per cent were females.

From the Pondville Hospital (Massachusetts Department of Public Health) Walpole, Massachusetts.

All of the patients were of the white race. It should be noted however that very few colored patients are seen at the Pondville Hospital.

A positive Wassermann or Hinton reaction was found in 7.2 per cent of the patients examined. This is comparable to the 6 per cent reported by Hayes Martin and associates (4).

The lower lip was the site of the primary tumor in 497 patients. There were 19 tumors of the upper lip and 47 of the labial commissures. The right and left sides were involved with approximately equal frequency.

The median duration of disease at the time of the first visit to the Pondville Clinic was found to be 6 months. This figure is considered more accurate than the average duration of 17 months because the latter resulted from the fact that a few lesions were said to have existed for as long as 20 years. It is felt probable that malignant tumors superimposed upon long standing precancerous conditions account for these cases of extremely long duration.

In this connection it seems surprising that a patient will allow an obvious lesion occupying a prominent position on the lip to go untreated for such a period of time particularly since it must be seen daily in a mirror. However the growth is slow and gradual as a rule and painless if uncomplicated by infection. Furthermore it must be noted that the responsibility for delay between onset of the disease and the presentation of the patient for treatment does not rest solely with the patient. Many physicians not recognizing the true nature of the process are guilty of procrastination or inadequate and ineffectual treatment with a variety of salves, antiseptics, pastes or minimal doses of radiation. This is particularly unfortunate because lesions 1 centimeter or less in diameter can be treated with almost

certain assurance of complete success. It is hoped that the present-day increase in cancer consciousness will tend to eliminate some of this delay.

The size of the primary lesion was recorded in 349 cases. The great majority (76.5 per cent) of these had a maximum diameter of 2.0 centimeters or less, while 39.2 per cent measured 1.0 centimeter or less in greatest diameter. The majority of the remainder had a range from 2.1 to 5.0 centimeters in size. A small number of extensive growths measured from 5.1 to as much as 12 centimeters.

In the records studied definite information concerning both oral hygiene and the use or non use of tobacco was available in 356 cases. Of this total 335 patients were classified as habitual tobacco users. Three hundred and ten of these had either poor oral hygiene (58.1 per cent) or were edentulous (41.9 per cent). On the other hand only 21 patients used no tobacco and 18 of these had poor oral hygiene or were edentulous. Only 28 or 7.8 per cent of the entire group had a good or fair oral condition. Seventy-one per cent of those who used tobacco smoked a pipe.

The edentulous group deserves some comment. This is a separate category because its members did not fall by description into either of the other two groups. It might be argued that the edentulous patients, having no dirty or carious teeth or infected gingiva had good or at least fair oral hygiene. On the other hand it might be said that these patients had lost their teeth for the very reason that they had had poor oral hygiene.

Sixty-two patients gave a definite history of trauma prior to the appearance of the tumor. These included not only such single episodes as a cut while shaving a cigarette burn an injury in the course of tooth extraction or a burn from sparks while engaged in welding, but also repeated injuries from poorly fitting dentures sharp jagged teeth or the holding of roofing nails and bristles in the mouth in daily work. None of these patients were found to have good or even fair oral hygiene. Forty-one however were recorded as having a poor oral condition and 21 as edentulous.

This is not meant to imply that single trauma is a cause of carcinoma of the lip; we do

feel however that trauma superimposed upon a background of poor oral hygiene may be of some significance.

It was found that *leucoplakia* or *keratosis* of the lip was associated with carcinoma in 81 cases (14.5 per cent) of the series.

Other *unassociated carcinomas* were observed in 67 of the patients, or 11.9 per cent of the entire group. Of this number 52 patients had, in addition to carcinoma of the lip a second malignant tumor; 11 had 2 other lesions, and 4 had 3 additional neoplasms.

#### PLAN OF TREATMENT

There has been considerable controversy in the literature concerning the treatment of choice in lip carcinoma and it is not the object of this paper to attempt to prove the relative advantage of one method of therapy over another. Suffice it to say that both radiation and surgery have their place in the treatment of carcinoma of the lip at the Pondville Hospital the emphasis has been on surgical therapy.

Examination of the patient in the Pondville Out Patient Department includes measurement of the lesion and careful palpation of the neck to determine the presence of lymph nodes. The size consistency tenderness, and mobility of any palpable nodes are noted, with particular attention to any asymmetry in the sides of the neck. On the basis of this examination a clinical impression as to the presence of lymph node metastases is noted in the record. The patient is also referred to the staff dentist for such hygienic measures as may be indicated and any necessary extractions.

Suitable patients are treated by a simple "V" excision performed under local anesthesia. The surgical treatment of the larger lesions involves a more extensive quadrilateral excision with some type of plastic reconstruction of the lip such as the one described by Daland.

It was noted that plastic procedures were carried out on 58 patients in this series; this was 11.8 per cent of all patients treated. Thirty-six of these 58 patients had primary tumors involving one-half or more of the lip and multiple stage operations were performed

In a few instances Seventy four per cent of the patients requiring plastic operations achieved 3 year cure status

Although several of the patients in this series, particularly in the early years underwent excision of the lip lesion and dissection of the cervical lymph nodes at one operation it is now preferred at Pondville to bring the primary lesion under control before attacking the lymph nodes Since lymph node metastases from carcinoma of the lip occur by way of emboli rather than by lymphatic permeation *en bloc* dissections of the primary lesion and the regional lymph node bearing areas are unnecessary The short period of delay enables better evaluation of the status of the lymph nodes by allowing inflammatory nodes to become quiescent after the eradication of sepsis within the mouth and incident to the tumor itself The staff may also be more confident that the primary lesion is really controlled before dissection of the regional nodes is carried out.

After excision of a carcinoma of the lip with no clinically demonstrable metastases the patient is followed in the out patient clinic and careful examination at 3 or 4 week intervals is made for the first 6 months and at 6 week intervals for the balance of the first year During the second year return visits are made every 2 months and thereafter the interval is gradually prolonged After the fifth year if no recurrence or metastasis has been found visits are made on an annual basis Because of the frequent follow up program made possible by an active and energetic social service department it is felt that prophylactic neck dissection would not offer sufficient added benefit to compensate for the effort and operative risk involved

When neck dissection is carried out however the supraomohyoid technique described by Taylor and Nathanson (7) is in most instances the procedure of choice since it has been shown that carcinoma of the lip metastasizes primarily to the upper cervical lymph nodes. Although most of the primary metastases are included in the more limited field comprising the submaxillary and submental triangles the extension of the field of dissection to the omohyoid muscle increases the

possibility of cure without materially adding to the risk or the time involved in the operation

In cases with more extensive metastases involving the jugular chain of nodes a more radical dissection is done, and the node bearing tissues including the sternocleidomastoid muscle and internal jugular vein are removed down to the level of the clavicle

#### SELECTION OF CASES FOR ANALYSIS

The end result analysis is based on data recorded for 491 patients 72 cases having been excluded as unsuitable for study for one of the following reasons Some patients having received all of their treatment elsewhere had reported to our out patient clinic for diagnosis only A few patients were admitted for terminal care they were moribund on admission and were given no definitive treatment We also excluded those who had been treated elsewhere and in whom no evidence of carcinoma was found at our clinic Nine patients whose diagnosis was basal cell carcinoma of the upper lip were excluded because it was felt that these carcinomas were tumors of the skin and did not arise in the mucosa of the lip A small number of patients could not be included because they left the hospital on their own responsibility and against advice before any treatment could be started

All but 6 of the remaining 491 cases have had complete follow up either by personal visits to our out patient department or to one of the state-aided tumor clinics of Massachusetts for a period of at least 5 years The 6 patients who were lost to follow up were included in the series and counted as treatment failures. Also included in this category were 4 patients living and free of disease at present who have had treatment for recurrences with in the past 3 years. All other patients who received any type of treatment whatsoever have been included in the analysis

#### CLASSIFICATION OF CASES

The 491 records were classified first as either primary or secondary cases The primary group includes those patients who received all their treatment at the Pondville Hospital and the secondary group those who had been

TABLE I.—END-RESULT ALL CASES

Total number of cases treated	491
Clinical diagnosis only—no pathological report	84
Died of intercurrent disease in less than 3 years, inconclusive	54
	3 <sup>5</sup> 38
Remaining	353
	Number Percent
Died with disease	66 30.0
Living and free of disease but had recent recurrence (treatment failures)	4
Lost to follow up (treatment failures)	6 7
3 year cures	37 67.1
5 year cures	203 63.6

treated inadequately elsewhere for carcinoma of the lip and then came to Pondville for further treatment

These two groups were then classified according to the type of therapy the patients received at Pondville: surgery (I), radiation (II) or combined (III). Group I consists of those cases in which the course of treatment was surgical eradication of the primary lesion, regional lymph nodes and any subsequent recurrence or metastasis. Group II includes those patients whose Pondville therapy was x-ray or the topical or interstitial application of radium or radon. In group III patients were treated by the combined use of surgery and radiation.

In evaluating end results a 3 year cure was defined as one in which a patient had remained free of any evidence of carcinoma of the lip for at least 3 years following last treatment and had never subsequently developed a recurrence. A 5 year cure is one in which a patient fulfills these criteria for a 5 year period. Those who are classified as having died of intercurrent disease survived less than 3 years after their last treatment, were adequately followed and were found to have no evidence of persistent or recurrent carcinoma at the time of death.

No pathological report is available for 84 patients who were treated by radiation on the basis of clinical diagnosis alone. These cases have been considered separately and are not included in the end results for all cases.

#### RESULTS OF TREATMENT

The total cure rate at the Pondville Hospital for all proved cases of carcinoma of the

TABLE II.—END-RESULT—CASES WITHOUT PATHOLOGICAL REPORT

Total number of cases	84
Died of intercurrent disease	3
Remaining	71
	Number Percent
Died with disease	22 30.9
3 year cures	40 60
5 year cures	42 65.2

lip irrespective of method of treatment, is 67.1 per cent based on the 3 year cures and 63.6 per cent based on the 5 year cures (Table I).

Inasmuch as our figures show only a slight difference between the percentages based on the 3 and 5 year cures and since this difference may be accounted for by normal loss through intercurrent disease in the age group concerned, it is felt that statistically the 3 year cure rate is an adequate measure of success in treatment of carcinoma of the lip.

We do not feel however that it is statistically sound to include those patients who were treated without pathological confirmation of the diagnosis. It is nevertheless of interest to note that the results of treatment in this group (Table II) are comparable to those in the group with proved diagnoses. Many early cases as well as those with obviously advanced disease are included in this group.

**Primary cases.** The primary group consisted of 242 cases. The results of therapy were analyzed according to the type of treatment these patients received and as can be seen from Table III the great majority of the cases were treated surgically. Before concluding from this table that the results of surgical therapy are far superior to those obtained by radiation or by a combination of surgery and radiation, it should be pointed out again that the preferred method of treatment of carcinoma of the lip at the Pondville Hospital is surgical. Therefore while in many favorable cases patients were treated in this manner the radiologists were called upon to treat many lesions which were far advanced and not suitable for surgery. Furthermore many of the earlier and smaller lesions which were treated by radiation were not subjected to biopsy and are therefore not included in Table III.

TABLE III.—END-RESULT—PRIMARY CASES  
ACCORDING TO METHOD OF TREATMENT

	No. of cases	Died with disease or treatment failure—%	3 year cures—%	5 year cures—%
Surgery	17	6.0	93.0	91.8
Radiation	34	50.0	47.1	43.5
Combined	16	4.7	58.3	51.6
Total	247	8	81.4	78.7

TABLE IV.—COMPARATIVE TABLE TO SHOW  
CURABILITY ACCORDING TO SIZE OF LESION

Size of lesion in cm.	All primary cases		Primary radiation		Primary surgical	
	No. of cases	3 year cures—%	No. of cases	3 year cures—%	No. of cases	3 year cures—%
Up to	33	97.0	26	100	96	98.6
1.1 to 2	115	8.5	7	7.7	83	88.0
2.1 to 3		6.5	7	50		7.4
3 to 4	20	46.7	7	50	3	00

It was felt that by comparing a group of lesions treated by radiation with a group of lesions of similar size treated surgically a clearer picture of the relative efficacy of surgery and radiation would be obtained. A group of 67 patients was therefore selected they had had radiation therapy only many were treated without a confirmatory pathological diagnosis. No lesion exceeded 4 centimeters in greatest diameter. Since it has been shown before that the end results in cases without confirmatory pathological diagnosis are comparable (Table II) to those in the pathologically proved cases, inclusion of some of these cases seemed justified in order to obtain a series which would be statistically significant. Seventy-eight and two-tenths per cent of this selected group of radiation cases were 3 year cures 76 per cent were 5 year cures. This more nearly approaches the results obtained by surgery.

Table IV shows the effect of therapy on lesions of comparable size treated either by surgery or by radiation. As might be expected the smaller lesions show a higher percentage of curability and this holds true for tumors up to 3 centimeters in greatest diameter. The curability rates of the larger lesions are not consistent partly because of the smaller number of cases involved and partly because of the fact that the group becomes, to a certain degree self-selective i.e., the large, slowly growing lesions of low grade malignancy metastasize late, whereas more highly malignant tumors would produce fatal metastases before attaining such size. It should be mentioned that all the lesions 1 centimeter or less in diameter were observed to respond favorably to treatment, and radiation and surgery were equally effective in treating these small tumors. Two of these patients, treated surgically, were lost

to follow up and were therefore counted as treatment failures.

In considering the group given combined therapy it should be pointed out that the program of treatment planned originally included both radiation and surgery in approximately only one-half the cases. This group included those patients who had radiation therapy to the primary lesion and prophylactic or immediate therapeutic dissection of the cervical lymph nodes those who had surgery of the primary lesion and either prophylactic or therapeutic radiation (either external or interstitial) to the neck and those in whom the primary lesion was treated by electrocoagulation and radiation. The remainder of the cases fall into either one of the two following groups: patients originally treated by surgery in whom the response to treatment was unsatisfactory or in whom a recurrence of disease or late metastasis was treated by radiation or patients originally treated by radiation in whom the response to treatment was unfavorable or in whom a recurrence of disease or late metastasis was treated by surgery.

In the primary group of patients treated by surgery (Table III) there were 12 treatment failures (69 per cent of the cases). Of this number 2 patients now living and free of disease have had recurrences within the past 3 years. Four patients have been lost to follow up and were therefore also regarded as treatment failures. Of the 6 patients known to be dead one refused neck dissection following excision of a carcinoma of the lip and subsequently died with advanced metastases. One man, aged 83 years was seen in the follow up clinic on only one occasion following an excision of a lesion of the lip and was reported to have died of carcinoma 9 months after oper-

TABLE V.—END-RESULT—SECONDARY CASES

	N cases	Died with disease or treatment failure—%	3 year cure—%	5 year cure—%
Surgery	4	25	7	69
Radiation	43	83	69	6
Combined	5	60	20	20
Total		80.9	26	14.6

ation. A third patient died with postoperative sepsis in the neck following V excision of a carcinoma of the lip and neck dissection done at a single operation. The fourth death was due to pneumonia following V excision. The fifth patient died with recurrent carcinoma in the neck after having had a neck dissection. The sixth death was that of a known cardiac patient subject to anginal attacks. He died on the operating table and autopsy showed death to be due to advanced coronary artery disease.

**Secondary cases.** Many of the secondary cases had advanced lesions when first seen in the Pondville Clinic. Some had been treated with cancer paste, inadequate excision or insufficient radiation therapy elsewhere. Several were referred for treatment of metastases and for palliative therapy of advanced disease. Only those cases with proved pathological diagnoses of carcinoma of the lip were included in this study and in Table V they are classified according to the type of treatment which they received at this hospital.

With surgical treatment the 3 year cure rate was found to be 71.4 per cent while that for radiation therapy was 6.9 per cent. The apparent low salvage rate resulting from radiation therapy is again explained by the fact that the radiologists were called upon to treat most of the unfavorable cases from the standpoint of palliation only.

TABLE VI.—COMMISSURE LESIONS

Total number of cases	48
Number with no pathological report	4
Died of intercurrent disease	6
Remaining	4
Died of disease	59.5%
Living and free of disease at present, but recent recurrence—treatment failure	2.4
Lost to follow up	2.4
3 year cures	35.7
5 year cures	34

TABLE VII.—RELATIONSHIP OF GRADE TO RECURRENCE

Grade	Number of cases	Recurrences—%
I	178	3.5
II	6	8.0
III	23	30.4
Not graded	17	5.9
Total	270	13.4

## COMMISSURE LESIONS

In reviewing this series of records we were impressed by the relatively greater resistance to treatment demonstrated by lesions of the labial commissures as compared to carcinomas located elsewhere on the lips. It was found that these lesions were difficult to control and local recurrences were more frequent than with other lip neoplasms. In fact it was observed that carcinomas in this location behaved identically with tumors of the buccal mucous membrane. Although these lesions were included in the computation of total end-results, it was felt that further study of them as a group was indicated. Table VI illustrates that the curability of lesions in this location is relatively low—the 3 year cure rate of 35.7 per cent is comparable to the 39 per cent local cures for carcinoma of the buccal mucosa reported by Taylor and Nathanson (7).

## GRADING OF LESIONS

An attempt was made to group all lesions into one of three pathological grades. Grade I included those lesions which on microscopic section showed numerous epithelial pearls, considerable keratinization readily visible intercellular bridges, less than two mitoses per high power field and only slight variation in size and shape of cells. Those lesions classified as grade II showed rare epithelial pearls or none at all, a moderate degree of keratinization, some intercellular bridges, an average of two to four mitoses per high power field and moderate variation in size and shape of cells.

TABLE VIII.—RELATIONSHIP OF GRADE TO NODE METASTASES

Grade	Primary Cases	
	Number of cases	Percent with node metastases
I	78	6.7
II	6	33.3
III	23	34.8
Not graded	17	35.3
Total	270	14.3

TABLE IX —RELATION OF GRADE TO CURABILITY—ALL CASES

Grade	No. cases	Died with disease or treatment failure—%	3 year cures—%	5 year cures—%
I	204	4.5	75.5	71.6
II	86	4.9	58	55.6
III	33	51.5	48.5	46.9
Not graded	30	43.3	56.7	56.7

Grade III lesions showed no epithelial pearls only slight keratinization no intercellular bridges an average of over four mitoses per high power field, and marked pleomorphism with the presence of tumor giant cells. The least well differentiated portion determined the pathological grade in those cases involving areas which apparently differed in degree of malignancy.

Thirty lesions out of a total of 407 biopsied cases, were found unsatisfactory for grading. Inspection of Tables VII and X indicates that the ungraded primary lesions have a low recurrence rate and a curability comparable to the grade I tumors while the ungraded secondary lesions seem to approach the grade II lesions in respect to these two factors. The difficulty in grading some of the secondary tumors was due to distortion of the cells resulting from previous treatment.

#### LOCAL RECURRENCES IN RELATION TO GRADE

We have defined recurrence as the appearance of carcinoma at or near the site of a lesion which had previously responded favorably to treatment. In many cases it was extremely difficult to differentiate between local recurrence and the appearance of a new and independent tumor and whenever there was any doubt on this point the second lesion was termed a recurrence. Forty three cases or 15.4 per cent, of the 279 primary cases had recurrent disease at some time after treatment (Table VII). Six cases lost to follow up were excluded in calculating the recurrence rate. Fifty per cent of the patients who had recurrent local disease ultimately achieved 5 year cure status.

Fifty-eight per cent of the recurrences were noted in less than 2 years and two-thirds of these appeared within 4 months. The remain-

TABLE X —RELATION OF GRADE TO CURABILITY  
Primary Cases

Grade	No. cases	Died with disease or treatment failure—%	3 year cures—%	5 year cures—%
I	58	6	87.4	84.8
II	50	32	68	65
III		33.3	66.7	65
Not graded	3	3.4	84.6	84.6

#### Secondary Cases

I	45	66.6	33.3	31.8
II	56	35.6	44.4	43.0
III		83.3	16.7	6.7
Not graded	7	64.7	35.3	35.3

ing 42 per cent (18 cases) developed recurrence in from 3 to 10 years. Although we have classified the patients in the latter group as recurrences it is probable that many of the cases were new tumors for these patients were under regular observation during the interim. Nearly all the late recurrences were grade I lesions. It was noted that grade II and grade III carcinomas tended to recur within the first 4 months after completion of treatment and rarely after more than 18 months. In the low grade lesions 5 year cures were ultimately effected in 80 per cent of the recurrences whereas only 25 per cent of the recurrent grade II and grade III lesions were cured.

One fifth of the recurrent tumors were of a higher pathological grade than were the primary tumors. This is doubtless explained on the basis that the most malignant portion of a tumor is more likely to metastasize and that the microscopic sections do not necessarily pass through the most malignant areas.

#### METASTASES IN RELATION TO GRADE

Metastases to lymph nodes occurred in 40 or 14.3 per cent of the primary cases. It was found that the occurrence of regional lymph node metastases as well as the rate of recurrence was directly proportional to the grade of malignancy of the primary cancer. This relationship is shown in Table VIII. It was also noted that 7 lesions metastasized as tumors of a higher pathological grade than the primary carcinoma.



TABLE XI—CURABILITY OF NODE  
METASTASES

Grade	All cases with positive nodes		Primary cases with positive nodes	
	No. cases	5 year cures—%	No. cases	5 year cures—%
I	7	29.8	20	70
II	5	20		8
III	16	6.3	7	14.3
Not graded	3	6.3	6	16.7
Total	26	1	33	2.4

## CURABILITY IN RELATION TO GRADE

Since the grade I carcinomas are less likely either to recur or to metastasize than tumors of higher pathological rating it might be expected that they would also respond favorably to treatment in a higher percentage of cases. This is indeed true and Table IX shows the relationship of grade of malignancy to curability for all lesions treated. Table X illustrates the same relationship with primary and secondary cases analyzed as separate groups.

## REGIONAL METASTASES

Metastatic carcinoma in regional lymph nodes was found in 113 patients. This group included patients with metastatic carcinoma proved by biopsy as well as several cases in which the patient ultimately died with gross tumor in the neck secondary to cancer of the lip but unconfirmed by biopsy.

Metastases occurred with greatest frequency (32.1 per cent) in lesions of from 12 to 24 months duration. The rate of occurrence then decreased to 14.7 per cent in lesions of from 2 to 10 years existence. No metastases were noted in the cases of 10 or more years duration and this might be expected inasmuch as the tumors were of low grade malignancy and the group as a whole self selective i.e. highly malignant lesions untreated for such a period of time would have resulted in early death. It was also found that the frequency of occurrence of metastases was in direct relationship to the size of the primary tumor. There was no regional node involvement when the primary lesion measured less than 0.5 centimeter in diameter but 14.9 per cent of the patients with lesions measuring up

TABLE XII—CURABILITY OF OPERABLE  
NODE METASTASES

Grade	All cases with operable positive nodes		Primary cases with operable positive nodes	
	No. cases	5 year cures—%	No. cases	5 year cures—%
I	14	50	7	28.6
II	5	20.0	7	28.6
III	8	5	5	20
Not graded		20		200
Total	30	29	29	20

to 2 centimeters in diameter developed cervical node metastases. Metastatic regional involvement was also noted in 23.8 per cent of the patients whose tumors measured from 2 to 4 centimeters and in 32.5 per cent of those with lesions exceeding 4 centimeters.

The curability of carcinoma in regional nodes was found to be directly related to the pathological grade of the tumor the highest percentage of cures having been obtained in the group of patients having the lowest grade tumors. Table XI shows that 15.1 per cent of all cases with metastatic carcinoma in the lymph nodes were 5 year cures. This group included patients who had received palliative therapy only as well as many advanced secondary cases. When only the primary cases (all treatment at the Pondville Hospital) are considered the cure rate is 32.4 per cent or slightly more than double that for the entire series.

Only 40.7 per cent of the entire group of patients and 65 per cent of the primary group were considered to have operable metastases. The criteria for operability were not rigid and in some instances radical dissections were carried out in cases with only slight hope of cure. Table XII indicates that 50 per cent of the primary cases and 35.9 per cent of all cases with operable metastases attained 5 year cure status.

There were no well authenticated cures of cervical metastases by any method other than surgical eradication in this series, although one case was open to speculation. The patient had a lesion of the mid lower lip excised at another hospital this was followed by excision of a submental node at Pondville 10 months later at which time pathological examination

TABLE XIII.—NECK DISSECTIONS

Patients with Negative Lymph Nodes

	Cases	Died with disease or treatment failure—%	3 year cures—%	5 year cures—%
Unilateral dissection	55	5.7*	64.3	63.3
Bilateral dissection	25		100.0	100.0

\*One postoperative death (sepsis)

Two died with uncontrolled primary disease

showed epidermoid carcinoma grade I Six months later three 2 millicurie gold radon seeds were implanted in a submaxillary lymph node in the right side of the neck although no biopsy was taken The patient died 9 years later of cardiorenal disease, apparently free of cancer

## RESULTS OF NECK DISSECTION

One hundred and seventy-one dissections of the cervical lymph nodes were carried out in 126 patients with an operative mortality of 2 patients (1.6 per cent of the group) Analysis was based on 119 patients since 7 patients were reported dead of intercurrent disease in less than 3 years after operation and were therefore excluded as inconclusive.

Negative lymph nodes were reported by the pathologist for 80 patients who submitted to neck dissection Table XIII summarizes the results for these cases. The 3 cases listed as treatment failures included one operative fatality as the patient developed sepsis in the neck following a 'V' excision of the lip lesion and neck dissection done at the same time The 2 other cases were patients in whom the primary lesion was uncontrolled at the time of the neck dissection one of these had a lesion involving the commissure The fact that the only treatment failures in this group were patients with uncontrolled primary lesions emphasizes the importance of cure of the local tumor before an attempt is made to treat regional metastases.

In 39 cases metastatic carcinoma in the lymph nodes was present at the time of neck dissection A unilateral operation was carried out in 23 instances and 16 bilateral upper neck dissections were performed The cure rate for all patients who had neck dissection

TABLE XIV —NECK DISSECTIONS

Patients with Proved Positive Nodes

	Cases	Died with disease or treatment failure—%	3 year cures—%	5 year cures—%
Unilateral dissection	23	73.0	16	16
Bilateral dissection	16	50	50	50
Total	39	64.3	35.0	33.0
Primary controlled	33	57.6	4.4	42.4

and proved metastases to the nodes was 35.9 per cent, as set forth in Table XII

It was felt that the low cure rate for unilateral dissections warranted further analysis Investigation revealed that 17 cases or 73.9 per cent of the group were listed as treatment failures for one of the following reasons Six of these patients developed recurrences in the primary tumor after unilateral neck dissection had been carried out indicating that the primary was not controlled at the time of the secondary procedure Three of these 6 had commissure lesions and 1 had extension of disease into the buccal mucosa Because of the local recurrence dissection of the other side of the neck was therefore not carried out in these cases and a seventh patient refused surgery to the second side It is obvious therefore that 6 of the treatment failures resulted from improper selection and that 1 patient refused completion of treatment. If one considers only those cases in which the primary disease was controlled before neck dissection was carried out, 42.4 per cent of the group are found to be 5 year cures

## CONCLUSIONS

1 Carcinoma of the lip is the most readily curable malignant tumor of the oral cavity and treatment of 407 unselected cases at the Pondville Hospital resulted in 67.1 per cent 3 year cures Of the patients who received all their treatment at Pondville 81.4 per cent achieved 3 year cure status

2 Surgery is the preferred method of treatment at the Pondville Hospital

3 Three year cures are as significant statistically as 5 year cures in carcinoma of the lip

4 Carcinomas of the labial commissures are approximately twice as difficult to control as lesions in other locations on the lips.

5 Curability of carcinoma of the lip is directly related to the size and pathological grade of the primary tumor and the presence (or absence) of lymph node metastases.

6 It was found that 35.9 per cent of the patients who underwent neck dissection with pathologically proved cervical lymph node metastases attained the 3 year cure stage

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# BLOOD VOLUME AND OTHER DETERMINATIONS IN PREOPERATIVE AND POSTOPERATIVE CARE

## Their Practical Applications in the Average Hospital

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**D**ETERMINATION of the amounts of circulating blood plasma, hemoglobin plasma proteins and body proteins in a patient and the manner in which these amounts reflect the patient's ability to recover from operative and other wounds have recently attracted interest. Other studies have been made of the depletion incident to weight loss and malnutrition associated with a multitude of conditions and of determining loss and replacement of protein blood and its fractions by reliable laboratory procedures.

Some of the earlier work was based on plasma protein percentage values determined by plasma specific gravity as disclosed by the falling drop method with associated estimation of hematocrit. It soon became apparent that specific gravity plasma protein percentage concentration and hematocrit values were not reliable indicators of the status of the total proteins in the circulating plasma or body tissues. The values for whole blood sodium chloride bore little relationship to the sodium chloride intake and urinary output and could be disastrously misleading as Collier pointed out in a paper on salt intolerance repudiating his previous formula for the administration of salt solutions postoperatively.

During studies (4) on the use of protein hydrolysate given orally we found that a more accurate approximation of the clinical status of severely ill patients could be obtained by correcting the plasma protein percentage value to conform with an ideal hematocrit of 45 per cent. The plasma protein percentage values in patients with severe burns which had been grafted with skin were misleading and sometimes remained the same though the

grafts began to shrink in size and the condition of the patient was obviously worse. The corrected values tended to parallel the status of the graft and usually rose when the grafts did well and became lower when the grafts shrank. This observation was made frequently.

In other instances however plasma protein percentage values, hematocrits, erythrocyte counts and whole blood sodium chloride values failed to portray what we thought was occurring in the patient. Other workers have made similar observations. How then might the patient's status be determined more accurately?

In 1932 Chang reported that the volume of blood in humans with nutritional deficiency was reduced. The same phenomenon was observed by Holman, Mahoney and Whipple in animals rendered hypoproteinemic. Abbott and Mellors and Lyons called attention to the fact that the circulating plasma proteins, circulating hemoglobin and cell mass might be greatly reduced while the plasma protein percentage concentration, hemoglobin and hematocrit were within normal limits. Recently Clark, Nelson, Lyons, Mayerson and DeCamp re-emphasized the weight loss reduction of blood volume and increase of interstitial fluid volume which occur in patients with malnutrition, carcinomas, long standing gastrointestinal disturbances and other conditions.

Reduction in circulating blood volume therefore would seem to be the more important aspect of the nutritional deficiencies accompanying various surgical and medical diseases. Any attempt to restore the blood volume to normal by introduction of simple fluids will result in dilution of the cell mass and the total circulating plasma proteins, the former producing more severe grades of ane-

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mia and the latter reduction of the plasma protein concentration percentage. More profound degrees of anemia result in relative anoxia followed by passage of fluids into the interstitial spaces preventing restoration of the blood volume.

Actually then restoration of blood volume should depend on the introduction of adequate amounts of erythrocytes protein and fluid with electrolytes. Restoration may be impeded unless sufficient amounts of erythrocytes and protein are given. This is not entirely true of the noncellular fluid component as it may be to varying degree brought in from the interstitial fluids.

Since ordinary laboratory determinations of hemoglobin concentration percentage, hematocrit and plasma protein concentration percentage do not indicate the true circulating erythrocyte mass and hemoglobin circulating plasma volume and circulating plasma proteins how may the surgeon in the average hospital obtain the pertinent information from the laboratory. What are the required procedures within the limits of practicability for the average laboratory not engaged in research? Three simple tests are required. These tests are determinations of the plasma volume and of the specific gravities of the plasma and whole blood.

#### DETERMINATION OF CIRCULATING PLASMA VOLUME

Of all the methods of determining circulating plasma volume the simplest is the one we employ adapted from that of Gregersen which consists essentially of the injection of Evans blue dye (T 1824) into the venous circulation and measuring the concentration of the dye in the plasma after 10 minutes. While some investigators weigh the syringe and the needle before and after injecting the dye it is not necessary for routine use and the error is not large enough materially to affect the results of their translation into effective therapy.

**Equipment.** In our method of determining circulating plasma volume the following equipment is used (1) 4 Wintrobe tubes calibrated to 6 cubic centimeters containing 0.2 cubic centimeter of 1 per cent liquid heparin (2) 2 five cubic centimeter ampules of Evans

blue (T 1824) dye (3) 1 five cubic centimeter Luer Lok syringe with Luer Lok valve attached and 1 hypodermic needle (4) 2 twenty cubic centimeter Luer Lok syringes (5) at least 2 intravenous Luer Lok needles, No. 20 or No. 18 gauge with valves (6) tourniquet (7) watch with a second hand.

**Technique at bedside.** With a glass-marking pencil mark 2 of the Wintrobe tubes 'B' and 2 'A' to represent before and after injections of the dye. Set the two B tubes aside ready to receive blood. Take 1 ampule of Evans blue and make sure that all the solution is in the body of the ampule. Open the ampule in the usual manner with a file. Then take the 5 cubic centimeter syringe with valve and hypodermic needle and draw up the dye solution. The manufacturer has placed slightly more than 5 cubic centimeters in the ampule to allow for some loss in the needle and syringe barrel. If no dye has been left in the neck of the ampule usually about 5.3 cubic centimeters will come up in the syringe. Work out all air bubbles and adjust until 5.1 cubic centimeters remain in the syringe. The extra 0.1 cubic centimeter takes care of the loss of dye in the barrel of the syringe. Close the valve thus preventing any escape of the syringe contents, and remove the hypodermic needle. Place this syringe within easy reach for use following the next step. Apply the tourniquet for location of a vein only and remove it as soon as the vein is entered. Prolonged use of the tourniquet produces stasis resulting in serious error. The first 20 cubic centimeter syringe with intravenous needle is employed and blood is washed in and out of the syringe several times after making sure the tourniquet has been removed. Withdraw about 15 cubic centimeters of blood into the syringe turn the shut-off valve remove the syringe and introduce 6 cubic centimeters of blood into each B Wintrobe tube, cork each tube and invert to prevent clotting. Now take up the 5 cubic centimeter syringe with the dye and attach this unit to the needle and valve unit already in the vein. Open both valves, inject the dye rapidly and note the time of injection then rinse the syringe several times with blood close one of the valves and withdraw the needle from the vein.

Now start looking for a suitable vein in the opposite arm so that it will be ready for the taking of the blood sample at the end of 10 minutes. Do not use a tourniquet during this time, although it may be used momentarily prior to entering the vein for taking the sample. Use the second 20 cubic centimeter syringe with valve and intravenous needle enter the vein just prior to 10 minutes quickly remove the tourniquet wash the syringe with blood several times withdraw 15 cubic centimeters, close the valve, and remove the needle. Disconnect the syringe and introduce 6 cubic centimeters of blood into each of the A Wintrobe tubes cork and invert. Take all the tubes B and A to the laboratory with the second ampule of Evans blue (T 1824).

*Technique in laboratory* A  $\frac{1}{500}$  dilution of the other ampule of T 1824 dye is prepared by introducing 1 cubic centimeter of the dye with a 1 milliliter pipette into a 50 milliliter volumetric flask and filling it with water to the 50 milliliter line.  $\frac{1}{2}$  cubic centimeter of this dilution is introduced into  $4\frac{1}{2}$  cubic centimeters of plasma thereby making a final dilution of the dye of  $\frac{1}{500}$ , which is to be used in the colorimeter for comparison with the unknown.

Before centrifuging any of the blood determine the whole blood specific gravity from one of the B tubes by use of the copper sulfate method. The 4 Wintrobe tubes are then placed in the centrifuge and spun at 4,000 revolutions per minute for 15 minutes to give maximum packing of the cells. The hematocrit is determined and the plasma specific gravity is estimated by the copper sulfate method or the falling drop method of Barbour and Hamilton (2 3) if the equipment is customarily used.

The supernatant plasma of the B tubes is aspirated without disturbing the cells. Five cubic centimeters of the plasma is placed in a cuvette and read in a photoelectric colorimeter. This reading is the control value. Then remove  $\frac{1}{2}$  cubic centimeter of the plasma from the cuvette and substitute  $\frac{1}{2}$  cubic centimeter of the  $\frac{1}{500}$  dilution of T 1824 dye. Mix thoroughly and read in the colorimeter. This reading is the known standard value.

In another cuvette place 5 cubic centimeters of the supernatant plasma from the A tube

and read in the colorimeter. This is the *unknown*. The colorimetric reading of the control (Cont) is subtracted from both the standard (Std) and the unknown (Un) before calculating the plasma volume according to the following formula

$$Pl Vol = \frac{(Std - Cont) \times 2500}{(Un - Cont)}$$

After calculating the circulating plasma volume (PV) the total circulating blood volume is easily determined by the simple ratio  $PV/BV = Hpl/100$  where PV represents plasma volume BV total blood volume and Hpl the percentage of plasma obtained by subtracting the hematocrit from 100. The circulating erythrocyte volume may be calculated if desired by subtracting the plasma volume from the total blood volume.

#### SPECIFIC GRAVITY OF PLASMA AND WHOLE BLOOD, HEMATOCRIT PLASMA PROTEINS HEMOGLOBIN

The specific gravity of plasma and of whole blood may be determined by several methods. Two are applicable to the average hospital laboratory. The first which we formerly used is the xylene bromo-benzene method of Barbour and Hamilton (2 3). It entails the use of a fairly large but portable piece of apparatus and requires some practice on the part of the technician. The method is simply mastered however and the calculations are not difficult. The specific gravity of the unknown may be read from the alignment chart which may be photographed and enlarged or purchased from a dealer in laboratory supplies from whom the entire apparatus may be obtained. We have found however that the copper sulfate method is simpler cheaper and requires less training and less time. The reader is referred to the work of Phillips Van Slyke *et al* (14) or the textbook on U S Army laboratory methods (17). Alignment charts are shown therein for calculating hemoglobin percentage plasma protein percentage and even the hematocrit from the whole blood and plasma specific gravities.

The method of Barbour and Hamilton is the more accurate but the apparatus is not universally obtainable. With the copper sulfate

method Edwards found that the results compare favorably with those obtained by photoelectric determination of hemoglobin.

There was also a good relation between the specific gravity of the plasma and Kjeldahl analyses for total proteins.

The method was found to be accurate to plus or minus 0.1 gram of protein per hundred cubic centimeters of plasma with not over 0.3 gram variation.

Hemoglobin percentage concentration and plasma protein percentage concentration are read directly from the appropriate alignment charts. The hemoglobin may be determined in the usual manner if desired. Those interested in the original formulation of the alignment between plasma specific gravity and the plasma protein content should refer to the work of Weech and his collaborators.

#### CALCULATED VALUES

Once all the available laboratory data have been presented to the surgeon he should determine the patient's weight for calculating the expected plasma and whole blood volumes, total hemoglobin and circulating plasma proteins, and by comparing with the corresponding amounts of each as determined from the laboratory data, discover the deficits. After multiplying the circulating plasma protein deficit in grams by 30 to take into account the loss of body protein (16) he will then have an estimate of the magnitude of the replacements of each component of the circulating blood and of body protein that will be necessary to make his patient a good operative risk.

All expected values are calculated from the patient's normal weight. In cases of extreme obesity, thinness or recent rapid gain of weight out of proportion to normal expectancy, it is better to use standard age, height and weight tables. These are readily available. The expected circulating blood volume, plasma volume and circulating hemoglobin mass are what we would normally expect if the patient were not ill. The corresponding determined values are what he actually has.

*Expected total blood, plasma and cell volumes, expected total hemoglobin.* These values may be calculated from weight, height and body surface area. Many investigations of correlation have been made by various workers. Row-

tree, Brown and Roth and Gibson and Evans concluded that blood volume bears a more constant relationship to body surface area than to weight, but the more recent work of Courtice with animals of such different surface areas as the rabbit, dog, goat and horse showed a close correlation with weight regardless of the area. Gregersen found similar close correlation with weight in humans. From these investigations it may be concluded that the following relationships exist between weight and circulating volumes:

$$\begin{aligned} \text{Expected total blood volume} &= \text{Kgm. (lbs.} \times 2.2) \\ &\times 85 \text{ expressed in c.c.} \\ \text{Expected total plasma volume} &= \text{Kgm. (lbs.} \times 2.2) \\ &\times 45 \text{ expressed in c.c.} \\ \text{Expected total cell volume} &= \text{Kgm. (lbs.} \times 2.2) \\ &\times 40 \text{ expressed in c.c.} \\ \text{Expected total gms. hemoglobin} &= \\ \text{blood volume} \times \text{hemoglobin (standard gms. \%)} & \\ 100 & \end{aligned}$$

*Determined plasma, cell and blood volumes and hemoglobin.* The plasma volume will have been determined according to the method described using Evans blue dye (T 1824). With this value all the others may be calculated using the formula  $PV/BV = Hpl/100$ . The total amount of circulating hemoglobin may be computed as follows:

$$\text{Total Hgb} = \frac{\text{Total bl. vol.} \times \text{Hgb (gms. \%)}}{100}$$

#### CALCULATION OF DEFICITS

The purpose of accumulating the data as outlined is to ascertain whether the patient's total blood volume, plasma volume, total circulating plasma proteins, total body protein, and hemoglobin deviate from normal and to what extent. When the deficits of the various components of the circulating blood have been calculated, proper steps may then be taken to correct them and lessen operative risk.

The data should be promptly recorded on a chart attached to the patient's record. These charts may be easily prepared by mimeographing. The headings should be placed in the left column and there should be 7 other columns across the sheet representing the 7 days of the week, similar to a temperature chart. The recommended headings are shown in the following example from our cases.

Weight kgm (lbs.+2.2)	62.5
Plasma, sp gr	1.0240
Whole blood, sp gr	1.0550
Hematocrit (cells) per cent	43
Erythrocytes	4,790,000
Hemoglobin grams per cent	13.9
Plasma protein grams per cent	5.85
Plasma expect vol (45Xkgm) c.c.	2,800
Determined vol c.c.	2,120
Deficit c.c.	680
Total blood vol. expect vol (85Xkgm) c.c.	5,300
Determined vol c.c.	4,000
Deficit c.c.	1,300
Hemoglobin expect gm	866
Determined gm	656
Deficit gm	210
Proteins expect total ( $P_v \times Pl.P + 100$ ) gm	196
Determined gm	124
Deficit gm	72
Body prot. deficit (X30) gm	2,160
Caloric requirement (kgm.X25) cal	1,562.5

CASE 1 St. B No 60346 From the foregoing data it is apparent that the patient, a male weighing 62.5 kilograms (137½ lbs) had deficits of hemoglobin and circulating plasma proteins disclosed by a shrunken blood volume of 4,000 cubic centimeters as compared with an expected volume of 5,300 cubic centimeters. He gave a long history of malnutrition incident to a diverticulum of the stomach with ulceration. In order to prepare him properly for major surgery he was given 1,500 cubic centimeters of whole blood and supplementary feedings of protein hydrolysate whole protein and carbohydrate. During the 2 weeks prior to his first operation our nitrogen balance studies showed that he retained the nitrogen equivalent of more than 1,000 grams of protein which was about half of the estimated depletion of total body proteins. He withstood laparotomy well was in negative nitrogen balance for 3 days, and then remained in positive balance. During the next 18 days the feeding of about 125 to 150 grams of protein daily led to retention of the nitrogen equivalent of another 816 grams of protein. Transthoracic resection of the gastric cardia with the ulcer was performed. The patient received 1,500 cubic centimeters of whole blood, intravenous amino acids and glucose tube and oral feedings of protein hydrolysates whole protein and carbohydrate during the postoperative period. On one day only the fourth day after operation, when the caloric coverage was below 60 per cent of basic requirements there was a negative nitrogen balance.

Examining the data more closely it will be found that there was a deficit of 210 grams of hemoglobin. If 16.3 grams per cent is taken as normal for our laboratory approximately 1,290 cubic centimeters of whole blood should have been required to bring the total amount up to the expected value. Likewise it is found

that there was a deficit of 1,300 cubic centimeters of whole blood. Thus the 1,500 cubic centimeters of whole blood given in amounts of 500 cubic centimeters on consecutive days were sufficient. While the plasma in the whole blood was sufficient to add approximately the deficit of 72 grams of circulating protein the deficit of body protein was 2,160 grams. By massive protein and carbohydrate feedings maintaining a satisfactory caloric intake over half of the entire loss was made up in the immediate preoperative period of 2 weeks thus changing the operative risk from substandard to good.

Blood volume studies are particularly valuable in determining the specific component of the blood which needs replacement. When total hemoglobin and total plasma protein are determined and compared with the estimated normal a very accurate picture of the patient's specific need is obtained. This is exemplified by one of our patients who had been suffering from prolonged uterine bleeding. The following is abstracted from her records.

CASE 2 St. B No 63,55 Weight—61.4 kilograms (135 lbs) Total blood volume expected—5,355 c.c. determined—4,352 c.c. deficit—1,003 c.c. Total plasma volume expected—835 c.c. determined—326 c.c. excess—426 c.c. Total cell volume expected—2,520 c.c. determined—1,091 c.c. deficit—1,429 c.c. Hematocrit 25 per cent. Total plasma proteins expected—198.45 grams determined—186.53 grams deficit—11.92 grams Hemoglobin 7.5 grams per cent. Total hemoglobin expected—803.25 grams determined—326.40 grams deficit—476.85 grams. These figures reveal a shrunken blood volume due primarily to a loss of red cell mass. The determined plasma volume was in excess of that which would be expected and the total plasma proteins showed a deficit of only 11.92 grams. There was, however, a total cell volume deficit of 1,429 cubic centimeters and a total hemoglobin deficit of 476.85 grams. The patient was in particular need of whole blood transfusions and iron.

The foregoing cases are illustrative of what can be done by utilizing the simple procedure as outlined calculating deficits and using indicated therapy. While we have carried out detailed nitrogen balance studies on many patients preoperatively and postoperatively and have gone into more detail regarding the caloric requirements and the relative merits of various forms of protein and protein deriva



tives such studies are for research purposes and are not expected of the average hospital. However the procedures as discussed herein are within the capacity of any hospital laboratory, are within the ability of average personnel, are not time consuming, are easily learned and performed, and are reasonably accurate.

It has been said that unless basal caloric requirements are met, large losses of administered amino acids would occur in the urine. We have been surprised to find that positive nitrogen balance can be maintained in occasional patients receiving as little as 60 per cent of their basal requirements. This percentage probably represents about the lower limit. In our experience, an average level of at least 75 per cent of the basal calories should be provided even with intravenous amino acid administration.

#### DISCUSSION

Gradual lowering of mortality and widening of the scope of surgery have been mainly due to advances in anesthesia and in preoperative and postoperative care, other factors being about equal. Many studies have demonstrated the changes which may occur in the circulating body fluids as well as the tissues themselves in the presence of trauma or illness, and have pointed the way to rational therapy. With any two series of similar cases, the proper assessment of a patient's status and correction of deficits may make the difference between death or prolonged convalescence in one and rapid recovery in the other.

Determination of weight, plasma and whole blood specific gravity and plasma volume with the calculation therefrom of hematocrit, hemoglobin percentage, plasma protein percentage, expected plasma volume and deficit, expected and determined whole blood volume and deficit, expected and determined total hemoglobin and deficit, expected and determined total circulating plasma proteins and deficit, and caloric requirements are essential to proper preoperative care. Since but three easily performed laboratory tests are required in addition to the simple determination of a patient's weight, the necessary data should be obtainable in any hospital. The plasma volume technique is easily mastered with little

practice. The determination of plasma and whole blood specific gravity by the copper sulfate method may be rapidly done at the bedside in most cases by almost anyone after a few trials. Certainly the calculation of the remaining data by simple arithmetic should offer no serious difficulties. In fact, the collection of the information is easier than the persistent application of proper methods to correct such deficiencies as the data may disclose.

It may be argued that even these simple laboratory tests are not needed for intelligent care, because whole blood and proteins may be given as the patient's clinical appearance seems to indicate. Emphatic exception must be taken to this attitude with the reminder that it is not uncommon to find serious deficits in persons who have not lost weight and who may appear to be reasonably good operative risks. Experience has taught us that while clinical impressions are often accurate, they may be disastrously misleading and should not be relied upon solely.

The entire hemoglobin deficit should be corrected by transfusions of whole blood up to 1,000 cubic centimeters daily, signifying on 16.3 grams of hemoglobin per 100 cubic centimeters, or whatever other standard may be in use. There is little danger of overloading the vascular tree by quantitative replacement in the absence of certain cardiac disturbances, and rarely will the erythrocytes and hemoglobin percentage in the introduced blood attain the ideal normal values of 5,000,000 cells and 16.3 grams respectively. Lyons has previously reported that restoration to standard values for weight did not result in significant hemoconcentration or overloading. Operative blood loss should be made up quantitatively during operation and then no further transfusion may be necessary unless there is further loss in the postoperative period. The loss at operation will vary with different surgeons and types of cases. There is usually a tendency to underestimate not only the loss of cells but also of plasma, which may escape in large quantities. While these facts are well known, they are sometimes overlooked.

The plasma volume deficit may be overcome simultaneously with the administration of whole blood, plasma being a part of the

whole, unless the plasma loss has been disproportionately large. In such a case quantitative replacement is indicated.

The correction of protein deficits however is not as simple. As has been stated the total circulating plasma protein deficit must be multiplied by 30 to determine the total protein deficit of the body. Obviously it is impossible to replace the missing protein within a day or two. Often it may be impossible to make quantitative replacement in the preoperative period and complete restitution may not be necessary. In Case 1 retention of the nitrogen equivalent of more than 1,000 grams of protein within 2 weeks prior to operation was accomplished by giving about 125 grams of protein daily. When there is little time to prepare a patient for an emergency operation replacement of blood volume deficit with whole blood will carry him through satisfactorily. Approximately 35 to 40 grams of protein mainly albumin are introduced with every 1,000 cubic centimeters of whole blood. When there is ample time patients should be prepared by oral feeding of protein carbohydrates and fat in quantities sufficient to more than cover the caloric requirements.

We have had much experience during the past 8 years with almost all of the available products containing protein and protein hydrolysates with or without carbohydrates and have come to the conclusion that hydrolysates are rarely necessary during the usual preoperative period. We prefer to give whole proteins of high biological value, when ever possible, up to 150 grams daily, being certain to give an equal amount of carbohydrate and some fat. Suitable commercial preparations are available and if these are not desired, skim milk powder may be used in various ways. Much ingenuity may be necessary to persuade patients to take large amounts of protein and carbohydrates. Certain fundamentals must, however, be kept in mind. The proteins used must contain adequate quantities of the essential amino acids and should be supplemented with carbohydrate in about equal amount so that the proteins are not used in the body to manufacture carbohydrate. If any of the essential amino acids are lacking or if one or more should be

seriously deficient retention of the remainder is impaired and they appear in large quantities in the urine. This may also occur when insufficient calories are given. With the ingestion of 150 grams each of protein and carbohydrate with a fair amount of supplementary fat the caloric intake is usually adequate. It is in the immediate postoperative period that the caloric intake is the greater problem. The daily requirements of various vitamins are also important and should be covered with doses well above the basal level giving proportionately larger doses to those patients that have vitamin deficiencies.

After the patient has been thoroughly prepared for operation and blood and plasma lost at operation have been quantitatively replaced the immediate postoperative management confronts us. We urge early postoperative ambulation commencing within the first 24 hours and allow the average patient to choose his diet on the second day supplementing it with about 50 to 100 grams each of protein and dextrose daily until he is able to eat enough food to cover all the requirements. The latter usually occurs within a few days. The average case presents no serious problem. When surgery has been performed on the gastrointestinal tract with anastomoses, colostomies or obstructive resections the ingestion of large bulk is inadvisable. It is in this period that protein hydrolysates take their rightful place and are given intravenously through indwelling tube or orally. There are several available commercial solutions of protein hydrolysates for intravenous use. All of them according to our nitrogen balance studies are capable of maintaining positive balance. We strongly favor the use of those hydrolysate solutions which are combined with 5 per cent dextrose because it is possible to come closer to giving the necessary calories without unduly burdening the vascular tree. It is not our intention to evaluate the various intravenous solutions here. Any surgeon may easily determine for himself, from the commercial brochures the content of essential amino acids, dextrose and sodium chloride in each product.

The daily sodium chloride requirement averages about 6 grams but during the first 48

to 72 hours after operation may be too much. Salt intolerance during the immediate postoperative period is common and the sodium chloride content of intravenous and oral medication should be known. When several thousand cubic centimeters of solution are administered daily the salt intake may be great. It is better therefore to refrain from giving any sodium chloride for at least 24 hours and thereafter the intake should be governed by the output. We recommend determining the plasma or whole blood sodium chloride which ever is customary in the given hospital before operation to learn if the concentration percentage is abnormally low so that restitution can be made. It is our practice to measure the daily urinary output to determine the sodium chloride concentration percentage on an aliquot portion calculate the total daily salt output and provide quantitative replacement. The calculation of the daily output in operative cases is one of the more important tests and is strongly recommended.

While administration of intravenous fluid amino acids and dextrose may be necessary following gastrointestinal resections and similar procedures the associated feeding of hydrolysate or whole protein orally should be accomplished as soon as possible. For that purpose we use an Abbott Rawson tube with all gastric resections and start hourly feedings at once through the long lumen of the tube which reaches far into the jejunum. Dextrose and additional fluid requirements may be covered through the intravenous route. All obstructive resections of the colon and resections with end to-end anastomosis are given hydrolysates and then whole protein by mouth. Our experience with such cases has been very gratifying and we have not encountered untoward distention or serious gastrointestinal reactions.

Finally it may be asked whether it is necessary to perform all the tests and calculations as outlined. The decision should be made on the clinical history and nature of the case. Probably they are unnecessary for normal healthy persons undergoing appendectomy hernioplasty or procedures of lesser magnitude. Preparations for cholecystectomy and even repair of ventral hernias which some-

times are entered into lightly are not complete without thorough evaluation of the patient's condition. In our opinion the field of usefulness of the laboratory routine should be enlarged rather than narrowed. In this way the surgeon may do better for the patient and for himself.

#### SUMMARY

1. Many patients with a variety of diseases have shrunken total blood volume with deficits of plasma hemoglobin and cells, circulating plasma proteins and body proteins.

2. The decreased blood volume with accompanying deficits may not be disclosed by the patient's weight and the usual laboratory estimations of hemoglobin hematocrit and plasma proteins.

3. If the decreased blood volume and its associated deficits are not recognized there may be serious consequences for the patient during and after operation.

4. A simple routine is proposed which is practical for any small hospital and which may give accurate appraisal of a patient's status before operation. The routine consists of three simple procedures: determination of the specific gravity of plasma and whole blood and of the circulating plasma and whole blood volumes with the dye T 1824 (Evans blue). The technique of each is given in detail. From values determined and the weight of the patient all other data are calculated by simple arithmetic. Recording of the data systematically on a chart is recommended. Case examples are given.

5. From the data it is possible to estimate accurately a patient's need for one or more of the components of the circulating blood.

6. Application of the data to preoperative and postoperative care is discussed.

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# SURGICAL ASPECTS OF HYPERPARATHYROIDISM

## Review of Sixty three Cases

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THE surgical problems associated with hyperparathyroidism broadly considered resolve themselves into the finding and removal of parathyroid tumors or the recognition and subtotal removal of hyperplastic tissue in cases of diffuse primary hyperplasia. The surgical difficulties have to do chiefly with the minuteness and varied locations of the parathyroid glands the small size of many of such tumors and the fact that the tumors may be multiple. Experience in the treatment of a sizable series of patients with hyperparathyroidism forms the basis for this report.

### NATURE OF PRESENT SERIES

Many cases in the present series have been reported previously (5 6 11 21 29 32 37 38). Alexander Pemberton Kepler and Broders reviewed the first 14 cases in the series with particular reference to pathologic aspects and Keating and Cook reviewed the succeeding 24 cases with particular attention to diagnosis. The cases of diffuse primary hyperplasia have been reported by Rogers (30) and by Rogers and Keating (31). In the first case in the present series the condition in question was recognized in December 1928 (37) shortly after the first case of proved hyperparathyroidism in the United States had been reported by Barr Bulger and Dixon. From 1928 to 1942 the diagnosis was proved in 12 cases only. During 1942 a particular interest in the disease developed and in that year 4 new instances of it were recognized. In each succeeding year at least 10 instances of hyperparathyroidism have been proved. In 1946 fifteen new patients with this disease were treated. The remarkable improvement in the number of instances of hyperparathyroidism found has been due largely to a planned effort to make the diagnosis in cases of renal lithiasis.

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Sixty three patients with proved hyperparathyroidism have been seen at the Mayo Clinic (through 1946). In 59 cases the diagnosis was proved at operation and in 4 it was verified at necropsy. In 4 cases (6.4 per cent) the disease was due to diffuse primary hyperplasia. In 2 of these the diagnosis was first made at necropsy and in the other 2 cases the patients were treated surgically. In 59 cases adenomas were found. In 1 case 2 adenomas were removed at the same operation. In each of 2 other cases, 1 adenoma was removed without influencing the hypercalcemia and hypophosphatemia so that probably a second adenoma existed in each case. If these 2 cases are acceptable as cases of multiple adenomas, then in 3 of the 59 cases of adenoma, the adenomas were multiple (5.1 per cent).

In addition to the 63 cases of proved hyperparathyroidism there were 7 other cases in which the clinical diagnosis of primary hyperparathyroidism seemed certain. In 6 of these 7 cases cervical and posterior superior mediastinal exploration only was carried out. In the seventh case cervical and anterior superior mediastinal exploration had been carried out before the patient was seen at the clinic and similar exploration was carried out here. Abnormal parathyroid tissue was not found in any of the 7 cases concerned. Six of the 7 patients have been considered as having undergone incomplete operations; the operation on the seventh has been considered as a surgical failure. Two of the remaining 6 patients were seen more than 15 years ago before the necessity of complete cervical and anterior superior mediastinal exploration was fully appreciated. One other patient died elsewhere 4 months after cervical exploration had been performed here with negative results. In the remaining 3 cases the importance of anterior superior mediastinal exploration was fully understood but for different reasons, was not carried out.

## FACTOR OF SEX

Contrary to some reports (13, 27) but in keeping with others (21, 22), there was no great difference between the number of men and the number of women in the present series (31 women, 32 men). The explanation for this difference as it occurs in reported series is apparent when patients in the present series with osteitis fibrosa cystica and those without are considered separately. Among those with osteitis fibrosa cystica, women outnumbered men in the ratio of 32 to 1 whereas in the group without classical osseous disease men outnumbered women in the ratio of 25 to 1.

## FACTOR OF AGE

The ages of the patients at the time treatment was carried out, varied from 14 to 68 years. Two patients were in the second decade, 10 were in the third, 18 were in the fourth, 15 were in the fifth, 14 were in the sixth and 4 were in the seventh.

## DURATION OF SYMPTOMS

The duration of symptoms varied greatly. In 1 case symptoms due to recurrent renal stones had been present for 27 years; in another case the diagnosis was established within 1 week after the first attack of renal colic. The mean duration of symptoms among patients with osteitis fibrosa cystica but without renal complications was 4.16 years; among those with osteitis fibrosa cystica and renal complications it was 4.37 years. The mean duration of symptoms among patients with minimal or nondiagnostic lesions of bone and with renal complications was 10.12 years; the mean duration of symptoms among those with no disease of bone but with renal complications was 7.75 years.

## DIAGNOSIS

Considering only cases of proved hyperparathyroidism in which the diagnosis was made during the life of the patient, about 20 per cent of the patients had generalized osteitis fibrosa cystica without renal complications. Somewhat less than 20 per cent had both renal complications and osteitis fibrosa cystica. Slightly more than 20 per cent had renal complications and some osteoporosis but not

osteitis fibrosa cystica. Approximately 35 per cent had complications of the urinary tract and no evidence of osseous disease. Generalized osteitis fibrosa cystica was present in less than 40 per cent of cases while nephrocalcinosis or urinary lithiasis was found in more than 70 per cent.

The importance of renal complications (2) is more clearly demonstrated if only these patients observed during the last 4 years of the study are considered. During this period 47 patients with proved hyperparathyroidism were seen; of these 47, forty-four received the diagnosis during life. Three patients without symptoms referable to either osseous or renal complications were seen during this time. Hence of this group of 47 there remained 41 patients with such symptoms. Osteitis fibrosa cystica was present in 27 per cent of these 41 patients and renal diseases were found in 88 per cent.

The 3 patients who did not have symptoms (6.8 per cent of the patients for whom the diagnosis was made during life in the past 4 years) are of particular interest since the diagnosis was established only because determinations of the content of calcium in the blood were carried out. In 2 of these 3 cases such determinations were done because of convulsions and in 1 case they were made because of postmenopausal osteoporosis. It is thus evident that although renal or osseous complications usually are present and serve to suggest the diagnosis, the disease may exist and be diagnosed in the complete absence of complications. Indeed in every case the diagnosis depends ultimately on the characteristic changes in values for calcium and phosphorus. If the adult patient<sup>1</sup> has not been receiving large amounts of vitamin D which produces changes in the values for calcium and phosphorus indistinguishable from those associated with hyperparathyroidism, the demonstration of hypercalcemia, hypophosphatemia, hypercalciuria and hyperphosphaturia will establish the diagnosis with complete certainty. (1) These characteristic findings may be

<sup>1</sup>Albright (1) has pointed out that children have an unstable calcium equilibrium and that osseous atrophy of disease, in children, may be associated with hypercalcemia, hypercalciuria and even with renal stones. The youngest patient in the present series was 14 years of age at the time the diagnosis was established.

modified in cases of chronic renal disease with retention of metabolites in that retention of phosphorus may occur with consequent depression of the level of calcium in the blood. Since the diagnosis can be made with such certainty it follows that cervical exploration never should be advised in an effort to establish the diagnosis and that the surgeon must accept the fact that an adenoma or primary hyperplasia exists in every case and be prepared to prolong the dissection until such abnormal parathyroid tissue is found.

#### PATHOLOGIC ASPECTS

Comprehensive reviews of the pathologic aspects of parathyroid tumors have been prepared by Castleman and Mallory, Alexander and associates, Norris (26) and others (3, 16) further extended discussion is beyond the scope of this review. Controversy still exists as to whether the usual so-called adenoma should be considered benign or malignant. In the present series no tumor either recurred locally or metastasized<sup>1</sup> in spite of the fact that local excision rather than radical resection was carried out. Hyperfunctioning malignant tumors which have both metastasized and recurred after local excision have been reported (18, 23, 24) however and the cytologic characteristics of such tumors have been so similar to those of tumors in the cases in our series that many on cytologic grounds, have been considered as malignant (5). To simplify discussion and since the same treatment was carried out regardless of the impression of the pathologist as to whether the tumor was benign or malignant the term adenoma has been used throughout the review. The term is used however without implications as to whether the adenoma was considered benign or malignant on cytologic grounds.

In the 4 cases of diffuse primary hyperplasia in the series, the hyperplasia was entirely typical (3). In the 2 cases in which surgical treatment was carried out pseudopodia which have figured prominently in descriptions of the gross appearance of primary hyperplasia

were not present although larger masses of hyperplastic tissue were lobulated and contained cystic and hemorrhagic areas (Figs. 1 and 2).

#### NORMAL PARATHYROID GLANDS

*Recognition* Although it is difficult to recognize normal parathyroid glands grossly there is agreement (8, 14, 15, 36) that after the surgeon has had practice he can recognize normal parathyroid glands grossly with considerable certainty. Some knowledge of the variation in size, number, color and location of the glands is imperative for the surgeon who proposes to operate because of disease of these glands.

*It eight size and number* A normal parathyroid gland weighs 30 to 40 milligrams and measures 6 to 7 millimeters by 3 to 4 millimeters by 1.5 to 2 millimeters (19, 20, 28, 36). The largest parathyroid gland in Welsh's (36) series measured 15 by 6 by 3 millimeters and the heaviest gland weighed 100 milligrams. Large parathyroid glands approach the size of parathyroid tumors particularly if the two parathyroid glands on the same side of the neck are fused. The number of parathyroid glands varies from 2 to 6 or even more. Gilmour and Martin (20) in a study of the parathyroid glands of 527 persons who came to necropsy found 4 glands in approximately 80 per cent, more than 4 glands in 6 per cent and fewer than 4 glands in 14 per cent. When 5 or 6 glands were found the supernumerary glands were small and were situated in the immediate vicinity of one of the normal glands. When only 2 or 3 glands were found their small total weight suggested that other parathyroid glands had not been found in the dissection. Experience at operation would tend to support the implications of the study of Gilmour and Martin (20) that 4 glands are present in the great majority of cases, and that when fewer than 4 glands are found it is more probable that glands have been missed in the dissection than that they are absent.

*Form* The normal parathyroid gland is so soft that its shape is usually determined by surrounding structures but when the gland is situated in loose areolar tissue it assumes an oval form. The surface is smooth but has a

<sup>1</sup>One instance of carcinoma of parathyroid origin with hyperparathyroidism, local recurrence, and regional metastasis has been observed at the Mayo Clinic since 1946. Report of this case appeared in the *Proceedings of the Staff Meetings of the Mayo Clinic*, 1948, 3: 8-14.

characteristic finely granular appearance caused by a network of minute vessels beneath a thin capsule. The vessels enter at a fairly definite hilus. Small adenomas retain most of the physical characteristics of the normal gland. Larger adenomas are more likely to be molded, flattened, or otherwise distorted by surrounding structures and those which weigh more than 2 or 3 grams generally assume an oval or globular form and demonstrate surface molding only.

**Color** The color of the normal gland varies according to the fat content. Before puberty the gland is composed of chief cells (12) and has a characteristic coffee-brown color. Fat cells which dilute the brown color with varying admixtures of yellow appear at puberty and increase progressively until the person attains the age of about 40 years. During middle age the fat tissue remains fairly constant. It does not increase with old age (12). The fat cells may be concentrated toward one extremity of the gland, sometimes giving the appearance of a partial halo. The gland frequently is enclosed within a small pad of fat (19, 36) and is evident only as a somewhat darker center within the fatty pad. Fat cells are absent in adenomatous tissue so that the color is darker brown than that of the usual adult gland. Small hemorrhagic and cystic portions often are found in both adenomas and in the enlarged glands of primary hyperplasia.

**Location** The aberrant location of many parathyroid glands is dependent in part on the migration of their anlagen during the embryologic period (15, 25, 35) and in part on the displacement of the adult gland, particularly an enlarged gland, caudally by both gravity and negative intrathoracic pressure (15, 33). The region in which a given gland may be found is predictable (14, 15, 33) and this fact constitutes the anatomic basis for the surgery of hyperparathyroidism. The superior parathyroid gland develops in close association with the lateral anlage of the thyroid gland (Fig. 3a) and migration during the developmental stage is not great. On the basis of embryologic migration the gland should lie between the upper level of the larynx and the lower pole of the thyroid gland in the space bounded anteriorly by the deep layer of the

middle cervical fascia and posteriorly by the prevertebral fascia. The gland is situated well posteriorly and lies on the pharynx or esophagus rather than on the thyroid gland (36). The usual position of the gland is not near the superior pole of the thyroid gland but at about the junction of the middle and upper thirds of the lobe. The superior gland lies in a plane dorsal to the recurrent laryngeal nerve and inferior thyroid artery (36). Although this gland is found more easily than the inferior gland because of its limited embryologic migration, its posterior and medial position in relation to the thyroid gland is well worthy of emphasis.

The inferior parathyroid gland develops embryologically in close association with the thymus gland (Fig. 3b). The anlage originates from the pharyngeal wall rostral to that of the superior gland and migrates caudally along with the thymus lateral to the developing superior parathyroid and thyroid glands. It may be carried so to speak completely into the anterior superior part of the mediastinum with the developing thymus (10) but usually its descent stops near the inferior pole of the thyroid gland. The inferior gland lies in a more ventral plane than the superior and usually is situated anterior to the recurrent laryngeal nerve and the inferior thyroid artery. In the adult person on a developmental basis the inferior parathyroid gland may be found in the visceral compartment of the cervical fascia at any level theoretically from the upper border of the larynx to well into the anterior superior or even into the anterior mediastinum. The more usual positions of the inferior gland are (1) associated with the posterolateral surface and inferior poles of the thyroid gland near the branches of the inferior thyroid artery but anterior to these arteries and (2) more medially usually in relationship to the inferior thyroid veins. In the latter case the inferior parathyroid gland may be some distance caudad to the thyroid gland.

In addition to being subject to variations in position dependent on embryologic development, adult parathyroid glands, particularly when enlarged, may be displaced caudally by the same forces that cause low lying adenomas of the thyroid gland to become intrathoracic.



If the gland is situated well posteriorly the displacement is toward or into the posterior superior mediastinum and if it is situated more anteriorly it may be displaced toward or into the anterior superior mediastinum. Because of the dorsal position of the superior parathyroid gland the displacement in the adult person is toward or into the posterior superior mediastinum. An inferior gland may be displaced either into the anterior superior or posterior superior mediastinum depending on its position before displacement (33).

Parathyroid glands occasionally are present on the anterior surface of the thyroid gland (34). Whether parathyroid glands are ever actually situated within the thyroid gland is still controversial. Welsh reported that he had never found parathyroid tissue continuous with thyroid tissue. Norris (25) found that in embryos developing thyroid tissue occasionally partially encircled a developing parathyroid gland but never completely surrounded it. Cope (15) reported that a parathyroid gland had not been found within the thyroid gland at the Massachusetts General Hospital. In the present series neither normal glands nor parathyroid adenomas were found within the thyroid gland. Conversely there have been occasional reports (17) of intrathyroid parathyroid adenomas. Gilmour (19) in a series of 428 necropsies found that very rarely parathyroid glands and thyroid gland tissue were fused without intervening connective tissue and added that in 2 cases a parathyroid gland was found well within the thyroid gland.

**Vascular pedicles.** A parathyroid gland in its more usual location receives its blood supply from the superior or inferior thyroid artery or from the anastomotic artery which courses along the posterior surface of the thyroid lobe. When the gland develops in the mediastinum it may receive its blood supply from any neighboring artery. Parathyroid glands which develop in the cervical region and are subsequently displaced into the mediastinum remain attached to the arterial system of the thyroid gland so that the displaced gland may be found by tracing the vascular pedicle downward. As a rule the pedicle originates close to the thyroid gland. All parathyroid glands

in the posterior superior part of the mediastinum have pedicles while those in the anterior superior mediastinum may or may not have pedicles (Fig 4).

#### PARATHYROID ADENOMAS

**Situation.** Adenomas may develop in any parathyroid gland wherever situated and enlarged glands in or near the superior strait of the thorax are likely to be displaced caudally. This tendency as well as the erroneous conception that the superior parathyroid gland is situated near the superior pole of the thyroid gland probably accounts for the fact that the majority of parathyroid adenomas have been thought to develop in the inferior parathyroid glands (27). Of the adenomas removed surgically in the present series 26 were on the left 27 were on the right 1 was in the midline and in 4 cases the location was not indicated in the operative note. The ratio of involved inferior to superior glands was approximately 3 to 2. It was evident however early in the review that adenomas found near the inferior pole of the thyroid gland usually were considered as having developed in the inferior parathyroid gland and often the gland was considered to have been an inferior gland on no other basis.

**Mediastinal adenomas.**—The reported incidence of mediastinal adenomas varies considerably and probably depends to a large extent on individual definition of a mediastinal adenoma. More than 80 per cent of the adenomas in Norris (27) collected series were in the region of the inferior glandule—that is, near or inferior to the inferior poles of the thyroid gland. Since the average size of the tumors in this series was 3.2 by 2.1 by 1.7 centimeters it is evident that many of the tumors must have extended into the superior part of the mediastinum. Norris reported however that in only 19 of the 281 cases (6.8 per cent) were the tumors mediastinal. In a series of 49 adenomas reported by Cope 9 were situated in the mediastinum 5 in the anterior superior and 4 in the posterior superior.

In the present series the classification of adenomas as cervical or mediastinal seemed so uncertain that the attempt was abandoned. However an estimate of the



Fig 1 Diffuse primary hyperplasia The total weight of hyperplastic tissue was 52.5 grams. The small cystic and hemorrhagic portions are clearly shown



Fig 2 Diffuse primary hyperplasia The large water clear cells are well shown All parathyroid tissue showed the same change Hematoxylin and eosin  $\times 110$

number of adenomas which could not be found by dissection under direct vision through the cervical approach was attempted. In 1 of the 57 cases in which adenomas were removed surgically, 2 adenomas were found making a total of 58 adenomas. In 2 cases after cervical and posterior superior mediastinal dissection, a single parathyroid adenoma was removed without influencing the disease. Presumably in both cases, a second adenoma was present and presuming further, it was situated in the mediastinum. In 3 cases adenomas which were not apparent on cervical exploration were removed from the anterior superior mediastinum. In 2 of these the anterior superior mediastinum was explored after the sternum had been split, in the third case a vascular pedicle leading into the mediastinum from the right inferior thyroid artery permitted sufficient dissection under direct vision for exposure and removal of the adenoma through the cervical approach (Fig 4). In addition to the 57 cases of proved tumors (58 adenomas), there were 6 cases in which clinical diagnosis had been regarded as certain but in which results of cervical dissection were negative. If it can be assumed that these 6 patients had mediastinal adenomas then of 64 adenomas (58 proved adenomas plus 6 hypothetic adenomas) 11 (17 per cent) were situated in the anterior superior part of the mediastinum and could not be removed under direct vision during the cervical exploration and posterior

superior mediastinal exploration. Such an incidence probably is too high since the assumption that an adenoma not found on cervical exploration is located in the mediastinum is not tenable.

**Size** The adenomas in the present series varied in weight from less than 100 milligrams to 101 grams (Figs 5, 6 and 7). In 17 per cent of cases the adenomas weighed less than 500 milligrams; in 25 per cent they weighed 1 gram or less; in almost 50 per cent they weighed 2.5 grams or less. In slightly more than 25 per cent of cases the adenoma weighed more than 5 grams. Small tumors obviously are more difficult to find surgically than are large tumors. In practice tumors which weigh more than 1 gram are recognized easily. Those materially smaller not only may be difficult to recognize but they may be well hidden within sulci of the thyroid gland or by other cervical or mediastinal structures since small tumors tend to be caught within crevices whereas larger tumors tend to be displaced into regions occupied by loose areolar tissue.

Some conception of the expected size of the tumor would be of considerable aid prior to operation. Castleman and Mallory were of the opinion that some correlation existed between the intensity of the disease as judged by the changes in values for calcium and phosphorus in the blood and the size of the tumor. Cope (15) proposed subsequently that this correlation could be used to determine whether

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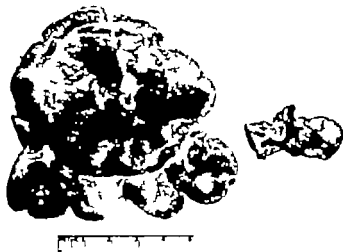


Fig 1. Diffuse primary hyperplasia. The total weight of hyperplastic tissue was 52.5 grams. The small cystic and hemorrhagic portions are clearly shown.

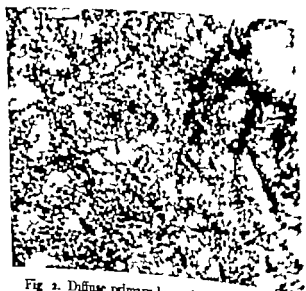


Fig 2. Diffuse primary hyperplasia. The large, clear cells are well shown. All parathyroid tissue underwent the same change. Hematoxylin and eosin  $\times 110$ .

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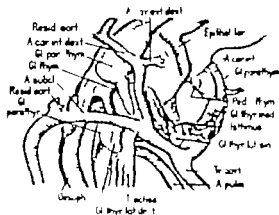
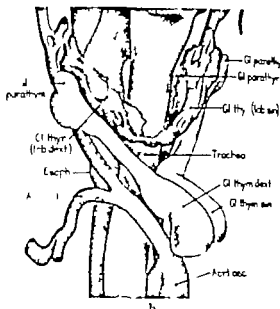


Fig. 3. Wax plate reconstruction of the thyroid, thymus and parathyroid gland and associated structures in the 4.5 millimeter embryo. The developmental relationship between the parathyroid gland (parathyroid 4) and parathyroid gland (parathyroid 3) is shown. The adult inferior parathyroid gland originates rostral to the adult superior parathyroid gland and in its descent it passes lateral and anterior to the adult superior gland. In this stage occupies approximately the same position as in postnatal life. The explanation for the usual position of the adult inferior parathyroid gland both lateral and anterior to the adult superior gland is evident from the reconstruction. The in-



timat location of the inferior parathyroid gland with the thyroid gland is well illustrated. (Reproduced, with permission of the publisher from W. D. C. L.: Development of the thyroid, parathyroid and thymus glands in man. Carnegie Institution of Washington Publication No. 443. Contribution to Embryology, 933, 24, 93-99.)



Fig. 4. An adenoma of the parathyroid gland displaced into the superior mediastinum. The vascular pedicle connecting with the thyroid arterial system is well shown, especially in the inset. Not all adenomas in the superior mediastinum have vascular pedicles originating in the cervical region.

or a second adenoma was present in a given case after one adenoma had been found. This correlation was studied in cases in the present series and although there were frequent exceptions there was some tendency for smaller tumors to be associated with lower values for calcium and larger tumors to accompany higher values for calcium. The correlation was more marked in the case of smaller tumors than larger tumors. The variation in size of adenomas associated with a given value of calcium in the blood was so great however that the presence of a second adenoma could not be postulated after the identification of one adenoma (Fig. 8). No correlation was found between duration of symptoms and size of the tumor or between the age of the patient and size of the tumor. Osteitis fibrosa cystica was associated with larger tumors more often than were renal complications although the correlation between values for calcium in the blood and size of the tumor was closer than that between osseous disease and size of the tumor.

#### TREATMENT

The necessity for meticulous dissection and the avoidance of blood stained tissues has long



Fig. 5.

Fig. 5 A parathyroid adenoma weight, 8 grams. The patient had osteitis fibrosa cystica and renal insufficiency.

Fig. 6 A parathyroid adenoma weight 3.5 grams. The patient had classical osteitis fibrosa cystica and nephrocalcinosis. The value for calcium in the blood fell from 18.7 milligrams per 100 cubic centimeters before the operation to 6.75 milligrams 18 days after the operation.



Fig. 7

Fig. 6

Fig. 7 A parathyroid adenoma associated with vascular pedicle showing pyriform shape weight 3.3 grams. The patient had recurrent nephrolithiasis and associated osseous disease. The value for calcium in the blood was 13.5 milligrams per 100 cubic centimeters before operation. It was 8.7 milligrams per 100 cubic centimeters after operation had been carried out.

been emphasized (14, 15) furthermore the surgeon must have developed the ability to recognize normal parathyroid glands. Immediate microscopic inspection of tissue by means of frozen sections should be available for the interpretation of specimens taken for biopsy and to aid in the recognition of diffuse primary hyperplasia. Biopsy should be employed sparingly and specimens for biopsy should be taken carefully because of the concomitant danger of destruction of a normal parathyroid gland. Adequate anesthesia for prolonged and extensive dissection in the neck must be provided. At the Mayo Clinic local anesthesia produced by 0.5 per cent procaine hydrochloride, augmented by nitrous oxide and oxygen is used invariably because of the possibility of injury to the recurrent laryngeal nerves. The aim of the operation is the methodical identification of each parathyroid gland and the golden opportunity for such identification is at the first operation. The recognition of normal parathyroid glands may be virtually impossible at secondary operations and normal glands in secondary procedures may be destroyed during the dissection which is far more difficult technically than at the primary operation. Nothing is gained by the removal of normal parathyroid glands in cases of hyperparathyroidism (14) if an

adenoma subsequently is found and removed chronic tetany will follow if all normal parathyroid tissue has been sacrificed. Because of the possibility of malignancy adenomas in variably should be removed completely (5). In cases of diffuse primary hyperplasia subtotal excision of the hyperplastic tissue should be carried out with the preservation of between 30 and 200 milligrams of hyperplastic

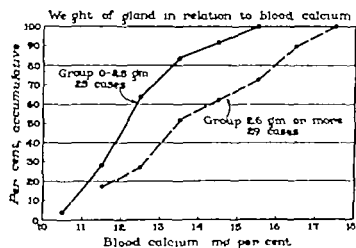


Fig. 8 The relationship of the value for blood calcium to the weight of the parathyroid gland. For instance 85 per cent of the patients with parathyroid adenomas weighing up to 2.5 grams had blood calcium values of 14 milligrams per 100 cubic centimeters or less, whereas among those with parathyroid tumors weighing more than 2.6 grams, only 57 per cent had so low a value for blood calcium.

tissue' (3-4) Care should be taken to guard the blood supply of the remnant.

I am in accord with the view of Cope (15) that exploration of the anterior superior mediastinum should not be done at the same time as the cervical and posterior superior mediastinal exploration; it should be done only after the cervical incision has healed and after the clinical course and chemical findings in the blood have demonstrated that the patient has not been cured. Complete cervical and posterior superior mediastinal dissection is a prolonged operation and with the knowledge that the entire operation is to be confined to these two regions dissection is likely to be more thorough than it would be if complete mediastinal dissection were carried out at the same operation. Blind blunt dissection of the anterior superior mediastinum through the cervical incision is to be condemned. It is not only dangerous but adenomas may be so soft that they cannot be recognized by palpation alone; they may be situated so far within the thorax that they cannot be reached finally; the scarring and hemorrhage resulting from blunt dissection will make subsequent exploration under direct vision of the anterior superior and anterior parts of the mediastinum more difficult and less certain. The posterior superior mediastinum is readily explored under direct vision through the cervical approach. Since the only way that parathyroid adenomas attain the posterior superior portion of the mediastinum is by displacement from the cervical region there invariably is a vascular pedicle arising from the arterial system of the thyroid gland.

The sequence of steps in cervical dissection is of little consequence as long as some systematic plan is followed. Cope (15) has suggested that since the superior parathyroid glands are comparatively easily found the two superior glands possibly should be identified first, whereas Norris (27) has pointed out that since more than 80 per cent of reported adenomas have been situated near the inferior

poles of the thyroid gland this area should be exposed first.

As a rule I carry out fairly complete dissection on the first side before crossing the midline. The same incision used for thyroidectomy is employed and after extensive mobilization and rotation of the lobe of the thyroid, the usual position of the superior parathyroid gland is explored. After gross identification of the superior parathyroid gland or after a reasonable search has failed to reveal it, dissection is continued distally around the inferior pole of the thyroid gland and toward the mediastinum. The areolar and fatty tissue around the inferior thyroid veins is carefully stripped from the veins. After the inferior gland has been identified grossly or after the area has been sufficiently dissected to demonstrate that the gland is not present in its more usual location the integrity of the recurrent laryngeal nerve is determined and similar dissection is carried out in the opposite side of the neck. Removal of specimens for biopsy and of parathyroid tissue should be postponed until this much of the bilateral dissection has been completed.

If then a tumor has not yet been found, dissection is extended as indicated by the missing parathyroid glands. For example if a superior parathyroid gland has been found, no further dissection need be carried out above the level of this gland. Conversely if a superior parathyroid gland has not been found this side of the neck must be explored from the upper border of the larynx to the inferior pole of the thyroid gland including the area anterior and medial to the superior pole behind the superior pole between the thyroid gland and esophagus or pharynx between the trachea and esophagus behind the esophagus and laterally around the carotid artery. If the inferior gland has not been identified the area of the dissection is extended as far as possible under direct vision into the anterior superior mediastinum and posteriorly well into the posterior superior mediastinum. If an adenoma still is not found dissection is similarly extended on the opposite side of the neck. The inferior thyroid artery and its larger branches as well as the anastomotic vessel between the inferior and superior thyroid arter-

<sup>1</sup>McFarlane and I (1) review 11 reported cases of primary hyperparathyroidism, with particular reference to the amount of tissue saved. Although reports are few persistent hyperparathyroidism as not observed when less than 200 milligrams, estimated weight, of tissue had been preserved and tetany as not observed when more than 50 milligrams, estimated weight, had been preserved.

ies will have been well cleared of areolar tissue on both sides by this stage of the dissection and vascular pedicles leading inferiorly should be evident if present. Such pedicles must not be divided during the dissection since they may lead to an adenoma in either the anterior superior or posterior superior mediastinum. If such a pedicle is present it usually is possible to follow it by dissection under direct vision, and to find and remove the adenoma since such adenomas are not displaced deeply into the mediastinum (Fig. 4).

Finally, if the adenoma still has not been found partial removal of one lobe or both lobes of the thyroid gland may be done particularly if the lobe is enlarged or nodular. The chance, however, of the finding of an intrathyroid parathyroid adenoma excluding parathyroid adenomas deep in a sulcus of the thyroid gland is remote.

At the conclusion of a fruitless, complete cervical exploration the surgeon should know which parathyroid gland is missing not only so that the side of the mediastinum in which the tumor is more likely to be found will be indicated, but also so that a check on the thoroughness of the cervical exploration will be provided. Unfortunately this ideal may not be achieved but even so, the principle is sound and adherence to it should encourage complete cervical dissection. In the usual case an adenoma will be found during the course of the cervical and posterior superior mediastinal dissection. In such a case, it is still necessary to carry out a reasonably complete bilateral cervical and posterior superior mediastinal dissection in order that other adenomas may be excluded.

*Mediastinal exploration.* As I have said exploration of the anterior superior part of the mediastinum should be delayed until the cervical incision has healed and until it can be demonstrated that the patient has not been cured. The exploration should be carried out through a sternum splitting approach of adequate size to afford exposure. Tumors lying within the thymus gland and within the plane of the great veins have been reported (15) if a tumor is not found during the dissection of the areolar tissue in the mediastinum thymectomy is indicated.

#### POSTOPERATIVE TETANY

Postoperative tetany in cases of hyperparathyroidism is better understood and less feared than formerly. Mild transient tetany may develop 3 or 4 days after operation because of either temporary hypoparathyroidism thought to be due to hypofunction of the remaining normal parathyroid glands or because of the sudden shift of the content of calcium and phosphorus in the blood. In the latter case symptoms of tetany may be present when values for calcium in the blood are higher than normal. Such tetany usually requires no treatment. In cases of advanced osseous disease particularly those in which values for alkaline phosphatase are higher than 20 Bodansky units per 100 cubic centimeters of serum severe tetany may develop. Albright (1) has postulated that in such cases the bones take up calcium and phosphorous ions so rapidly that serious depletion of these ions develops in the circulating blood. In such cases massive doses of calcium and vitamin D or dihydrotachysterol may be required. Permanent tetany results if all functioning parathyroid tissue has been removed or destroyed during the dissection. Permanent tetany requires continuous treatment with calcium and dihydrotachysterol.

In the present series of 57 patients who were cured surgically 30 did not have postoperative tetany whereas tetany of some degree developed in 27. In 2 patients in the latter group the tetany became permanent. The tetany of 15 patients was considered mild while in the remaining 10 patients severe symptoms developed. Symptoms of severe tetany were observed only in patients who had osteitis fibrosa cystica; conversely symptoms of severe tetany were not seen unless classical osseous disease was present.

#### SUMMARY

Sixty-three patients with proved hyperparathyroidism were observed at the Mayo Clinic through 1946. The disease was due to a single adenoma in 56 cases, to multiple adenomas in 3 cases and to diffuse primary hyperplasia in 4 cases. The ages of the patients ranged from the second to the seventh decade. Complications of the urinary tract were more common



and more important than osseous complications. The diagnosis was established with certainty in 3 cases in the absence of any complications on the basis of the characteristic changes in the content of calcium and phosphorus in the blood and urine. Since the diagnosis can be made with complete certainty, exploration of the parathyroid glands is never indicated to establish the diagnosis, and the surgeon must accept the fact that in every case of hyperparathyroidism one adenoma or more or primary hyperplasia is present.

The treatment of hyperparathyroidism is surgical. Adenomas should be removed completely and in cases of diffuse primary hyperplasia the hyperplastic tissue should be excised subtotally with the preservation of between 30 and 200 milligrams of hyperplastic tissue. In more than 80 per cent of cases the abnormal tissue may be found by dissection under direct vision through a cervical incision (cervical and posterior superior mediastinal dissection). A second operation through a sternotomy incision will be necessary in the remaining cases (anterior superior mediastinal dissection). Secondary dissection is more difficult and far less certain than primary dissection so that every effort should be made at complete operation both in identifying the parathyroid glands present and in designating those missing at the first cervical dissection.

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# INTERATRIAL SEPTAL DEFECT—ITS EXPERIMENTAL PRODUCTION UNDER DIRECT VISION WITHOUT INTERRUPTION OF THE CIRCULATION

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THERE is at present no well recognized technique for the production of interatrial septal defect although in a number of clinical conditions the establishment of such a defect might act to balance the right and left sides of the heart and thereby benefit the patient. In personal communications both Blakemore and Swan have mentioned this possibility. An analogous view has been expressed by Levine in commenting on the remarkable manner in which mitral stenosis and arterial hypertension may be tolerated when present in the same patient. Levine suggests an explanation based on equalization of the burdens on the right and left sides of the heart. Expressed in the form of a lay parable he says 'if one is to have a soft or flat tire on a motor car it would be of advantage to have the one on the other side in a similar condition'. It is known that patients with mitral stenosis and interatrial septal defect (the so called Lutembacher syndrome) may survive for remarkably long periods. In such instances according to White the deficiency of the interatrial septum has been credited with lightening the burden imposed on the pulmonary circulation and right ventricle by the mitral stenosis.

A number of methods may be used to produce interatrial septal defects. With the venae cavae occluded temporarily, one may approach the septum through a slit in the right auricle to produce the interatrial communication by incision with a knife by excision of a segment with scissors or with the electrosurgical unit or by simple punching with an instrument such as a hemostat.

None of these techniques provides the advantage of direct vision and there is moderate

loss of blood despite attempts at hemostasis by temporary complete obstruction of both venae cavae. Such occlusion of the cavae is poorly tolerated and the operation must be completed promptly to avoid cardiac arrest. Defects so produced are usually of a size which cannot be determined with accuracy at the time of operation and their persistence is highly problematical. We have been led by these considerations to develop a technique which permits the leisurely production of large interatrial defects under direct vision without undue loss of blood and obstruction to blood flow through the cavae or auricles.

## METHOD

Adult mongrel dogs were used varying in weight from 6 to 20 kilograms. Anesthesia was induced by drop ether followed by introduction of an endotracheal catheter with an inflatable cuff. A mechanical device provided regular periodic inflation of the lungs with ether vapor while the chest was open. The chest was entered through the right fourth intercostal space. Silk was employed as suture material throughout.

An important factor in the procedure is a special occlusive clamp described in a previous publication (2). This clamp (Fig. 1) consists of two semicircular jaws of rounded wire the upper one sliding in a grooved handle and capable of exerting pressure against the lower fixed jaw by means of a spring. A modified form of this clamp which approximates by screw action has been used successfully; the holding power is greater but there is increased danger of crushing the auricular wall.

## TECHNIQUE OF PRODUCING AN INTERATRIAL SEPTAL DEFECT

The method is based on the anatomical fact that the right superior pulmonary veins are

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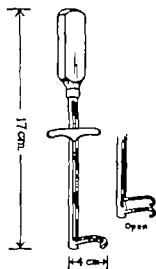


Fig. Clamp for occluding segment of blood vessel while allowing blood flow in its remaining portion. A spring in the handle maintains the jaws in contact.

closely adherent to the dorsal wall of the right auricle which forms one component of the interatrial septum. The ventral wall of these veins merges imperceptibly into that portion of the left auricular wall forming the interatrial septum. It is therefore indeterminate at what point the adherent walls of the pulmonary veins and right auricle may properly be said to become the interatrial septum; nevertheless it is possible by excision of the adherent walls

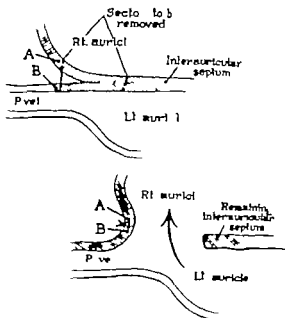


Fig. Relations between the two auricles and the pulmonary veins. (Compare with diagram in Fig. 4.)

of the right auricle and the pulmonary veins, to make a communication between the two sides of the heart. This principle is illustrated in the accompanying diagram (Fig. 2).

The pulmonary veins from the apical and cardiac lobes of the right lung are isolated over a 15 millimeter area between the parenchyma of the lung and their point of passage dorsal to the right auricle (Fig. 3). The pericardium is incised along its attachment to the pulmonary veins and reflected to the left, exposing the ventral aspect of the right auricle. The arterial supply to the lobes is occluded during the procedure by bulldog clamps or more conveniently by traction on braided silk ligatures passed around the vessels. With the pulmonary veins occluded distally by traction on braided silk ligatures, the spring clamp is applied so that the fixed jaw lies dorsal to the pulmonary veins and the movable jaw lies ventral to the right auricle (Fig. 4). On closure the clamp includes the ventral wall of the right auricle, the interatrial septum, and the dorsal wall of the superior pulmonary veins at their point of entry into the left auricle. These relations are shown in Figure 5b. The right inferior pulmonary veins and all the left pulmonary veins empty freely into the

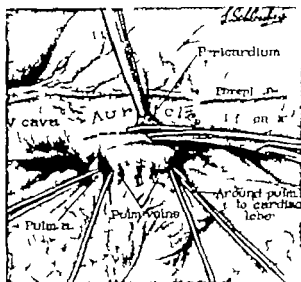


Fig. 3. The pericardium is being reflected to expose the lateral aspect of the right auricle.

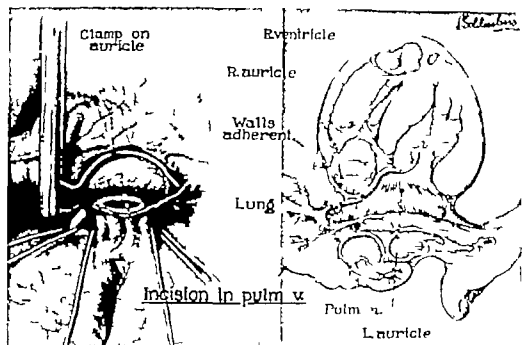


Fig. 4. Pericardium opened clamp in place and incision in ventral surface of the pulmonary vein. (Compare with diagram in Fig. 2.)

left auricle, nor is there any interference with inflow from either vena cava.

It is apparent that with an incision in the pulmonary vein and in the right auricle one has rendered visible within the clamp both intimal surfaces of the interatrial septum (Fig. 5a). By exerting traction on this isolated septum one may remove with scissors up to 2 centimeters of its most lateral portion still maintaining a bloodless field within the jaws of the clamp. Occasionally the cut edge of the septum will retract medially between the jaws

of the clamp but this serves only to establish the interatrial communication before removal of the clamp. It does not result in bleeding because the ventral wall of the right auricle is still approximated to the dorsal intimal surface of the pulmonary veins. The free lateral edge of the right auricle is then fixed to the distal ventral wall of the pulmonary veins by a running mattress suture of No. 00000 braided silk on an atraumatic needle (Fig. 6). Additional sutures are rarely required. The entire suture line is superficial since the dorsal half of the

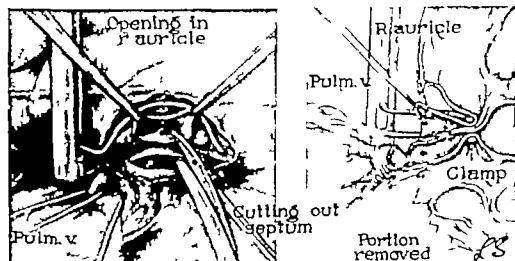


Fig. 5. a, left, Right auricle and pulmonary veins have been opened and the septum is being cut away with scissors. b, right, Diagram showing clamp in place with a segment of interatrial septum prepared for excision.

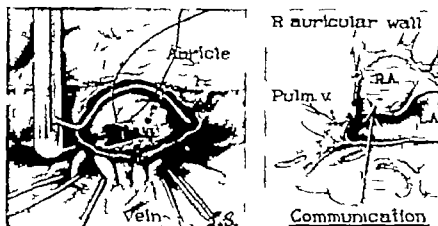


Fig. 6 a, left, With the interatrial septum removed, the ventral wall of the auricle is being sutured to the ventral wall of the pulmonary veins b, right Diagram of completed defect. (Compare with diagram in Fig. 2.)

pulmonary veins is intact. The pericardium is closed by a few sutures of fine silk covering the site of the anastomosis.

#### RESULTS

The operation as described was performed on 31 dogs. One animal died during operation because the clamp had been improperly applied and obstructed the vena cava. One died of distemper 9 days after operation and another of widespread pleural and pericardial infection after 6 days. In both of these latter dogs the defects were found at autopsy to be fully patent.

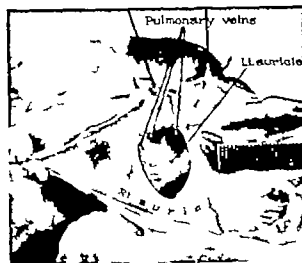


Fig. 7 Interatrial septal defect viewed from within right auricle 63 days after operation. Note the left auricle with its entering pulmonary veins.

Of the remaining 28 dogs 5 are alive and in good condition from 4 to 7 months after operation. Twenty three dogs were killed under anesthesia from 10 to 114 days after operation. In 16 of these there were large smoothly healed defects without evidence of scarring or constriction. A typical result is seen in the accompanying photograph taken approximately 2 months after operation (Fig. 7). The defect measures 20 by 13 millimeters and

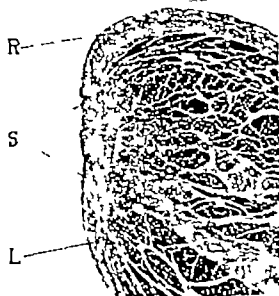


Fig. 8 Free edge of remaining interatrial septum showing smoothly covered muscle 30 days after operation. X65. R, Endocardium of right auricle, L, endocardium of left auricle; S, scar.

through it one can see the openings of the pulmonary veins. Of the remaining 7 dogs 2 showed marked constriction of the defect and in 5 there was complete occlusion of the opening. None of the dogs showed any symptoms attributable to the septal defect although in those surviving for long periods there was some cardiac enlargement.

It is difficult to assign exact causes for the failures reported but undue trauma to the suture in early experiments and the excision of very small segments of the septum in some instances undoubtedly led to most of the poor results. When it was realized that large defects were well tolerated the more radical excision was used and produced better results.

Healing of the free edge of the remaining interatrial septum was usually smooth and there was little tendency for closure of the defect by hyperplastic scarring or by adherence to surrounding tissues. The type of healing may be seen in Figure 8.

#### SUMMARY

A technique has been described by the use of which one may produce interatrial septal de-

fects under direct vision without interruption of the circulation with minimal loss of blood with fairly accurate control of size and with good prospect of maintained patency. The results have been considered to be satisfactory in 16 of the 23 animals which were examined at autopsy from 10 to 114 days subsequent to operation.

The possible use of interatrial septal defects as a therapeutic measure has been commented on briefly in a previous communication dealing with complete transposition of the pulmonary artery and aorta. Possible applications of this method to balancing the work of the two sides of the heart under certain abnormal conditions await further investigations.

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# STUDIES ON VAGOTOMY IN THE TREATMENT OF PEPTIC ULCER

## III Physiological Aspect

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THE history of vagotomy and its use in the treatment of peptic ulcer have been recently reviewed (31-32). It is likely that all of the procedures used in man by the early workers in this field resulted in only partial vagus section. Dragstedt's introduction of complete vagotomy as a treatment for peptic ulcer in 1943 (7) has caused renewed interest in the subject.

In June of 1946 a study of vagotomy in the treatment of peptic ulcer was started on one of the surgical services at the Cook County Hospital (K.A.M.). During the following year vagus section was carried out in 35 instances of peptic ulcer in which surgery was indicated. A report on the use of ulin in testing for completeness of vagotomy (42) and a clinical evaluation of the study (21) are published elsewhere. The present report is concerned primarily with the changes in gastric function following vagotomy.

Studies on the effect of vagotomy on gastric function in man have been previously reported. A decrease in the volume and acidity of the night secretion and a decrease in gastric motility following vagotomy have been constant findings. Dragstedt (6) and Thornton (34, 35) state that vagotomy has no effect on the secretory response of the stomach to histamine and caffeine. Moore (22, 23) states that the secretory response to histamine is unchanged following vagotomy. Crimmon (11) and Smithwick report that some patients have a decreased gastric response to histamine following vagotomy.

### TESTS

Physiological studies of the stomach were made before and after vagotomy in 30 pa-

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tients. Each of the following determinations was made on a significant number of patients before and after surgery: (1) 12 hour night secretion (2) basal secretion (3) the effect of histamine on gastric secretion (4) the effect of caffeine on gastric secretion (5) the effect of atropine on basal secretion (6) the spontaneous motility of the stomach and the effect of ulin on secretion and motility (7) the pain threshold to electrical stimulation and (8) the production of pain by the introduction of acid into the stomach. The method employed and the results will be discussed for each test. The secretory studies reported were conducted on patients in whom the ulcer was duodenal in location. There is a different group of patients for each study although considerable overlap exists.

### 1 Twelve Hour Night Secretion

**Method.** The patients were fed a standard soft diet at 4:30 p.m. and allowed nothing by mouth thereafter. At 7:30 p.m. a Levine tube was passed into the stomach and the stomach was emptied. Continuous suction was maintained from 8 p.m. until 8 a.m. when the 12 hour specimen of gastric juice was collected for acid determination (20, 28, 37).

**Results.** The results are summarized in Table I. Before surgery the average night secretion of 70 determinations in 22 patients was 47.4 milliequivalents per 12 hours with a range of 0 to 154.0 milliequivalents per 12 hours. After complete vagotomy and gastrectomy the average night secretion of 38 determinations in 14 patients was 1.5 milliequivalents per 12 hours with a range of 0 to 11.8 milliequivalents per 12 hours, a decrease of 97 per cent from the preoperative value.

After complete vagotomy without gastrectomy the average night secretion of 13 determinations in 4 patients was 3.0 milli-

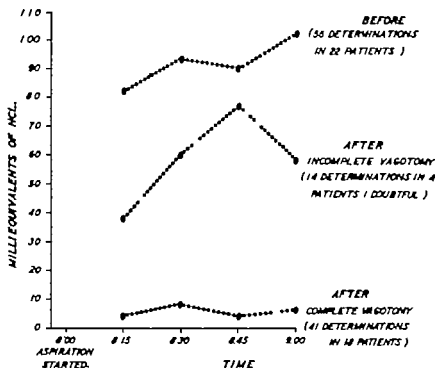


Fig 1 Average basal secretion before and after vagotomy (16 hours previous fasting)

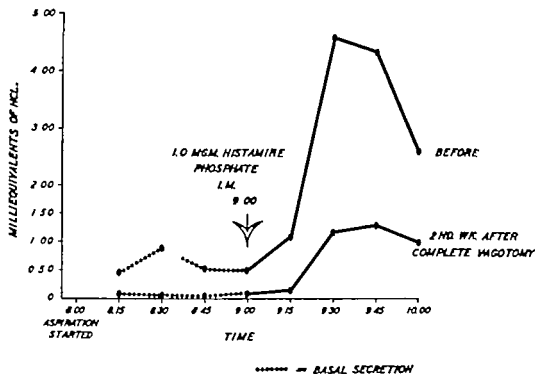


Fig 2 The effect of histamine on gastric acidity before and after vagotomy (average of 11 patients)

equivalents per 12 hours with a range of 0 to 12.3 milliequivalents per 12 hours.

After incomplete vagotomy the average night secretion of 10 determinations in 3 patients was 12.7 milliequivalents per 12 hours with a range of 3.2 to 48.5 milliequivalents per 12 hours.

## 2 Basal Secretion

**Method** The determination of basal secretion (2, 17) was usually preceded by a night secretion study. When not preceded by a night secretion study, complete aspiration of the gastric residuum was performed at the beginning of the test. In all instances when the basal se-



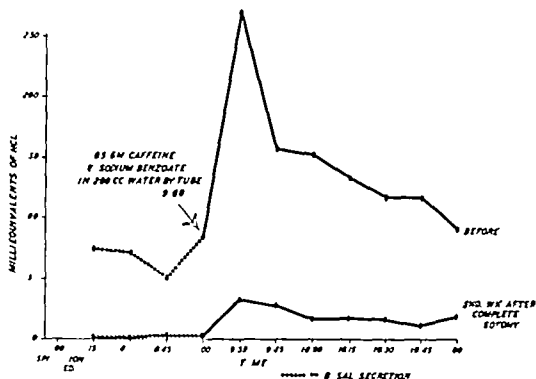


Fig. 3. The effect of caffeine on gastric acidity before and after gastrectomy (stage of 12 patient)

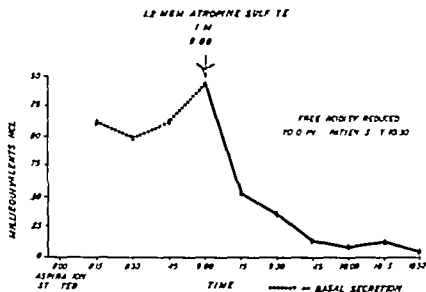


Fig. 4. The effect of atropine on gastric acidity (stage of 1 patient)

cretion study was started at 8 a.m. the patient had not eaten since 4:30 p.m. the previous day and usually the Levine tube had been in place all night. The stomach was kept empty by means of continuous syringe aspiration and

the specimen of gastric secretion collected at 15 minute intervals for titration. The acid response during the period of basal secretion was used as a control for the subsequent secretory study. Basal secretion was deter-

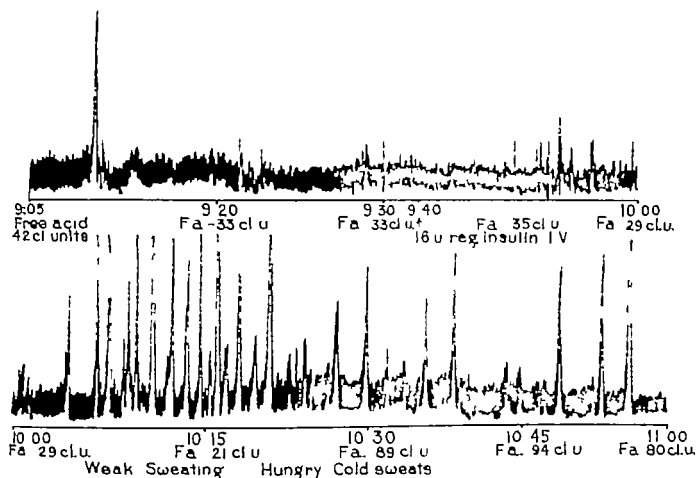


Fig. 5. Preoperative insulin test. Motility tracing showing spontaneous and insulin induced hunger contractions.

mined for 1 hour before a stimulant or depressant drug was administered. If however there was a marked spontaneous rise or fall in the basal secretion the control period was continued until a fairly constant rate of secretion was reached.

**Results.** Before vagus section, the average basal secretion of 56 determinations in 22 patients was 3.7 milliequivalents per hour (Fig. 1). The average of 14 determinations in 4 patients following incomplete vagotomy was 2.3 milliequivalents per hour. The average of 41 determinations in 18 patients following complete vagotomy was 0.2 milliequivalents per hour, a decrease of 95 per cent from the preoperative value.

### 3 The Effect of Histamine

**Method.** Following a period of at least 1 hour of basal secretion an intramuscular injection of 10 milligram of histamine phosphate was given. Aspiration of the stomach was

continued as during the basal period and the sample titrated at 15 minute intervals.

**Results.** Figure 2 is a composite curve demonstrating the secretory response of the stomach to histamine before and after complete vagotomy. The average secretory response in 11 patients was 12.7 milliequivalents per hour before surgery and 3.6 milliequivalents after complete vagotomy.

TABLE I — TWELVE HOUR NIGHT SECRETION BEFORE AND AFTER VAGOTOMY

	Free acid milliequivalents		Number of determinations	Number of patients
	mean	range		
Before operation	47.4	0-54	70	2
After operation				
Complete vagotomy with gastroenterostomy	5	0-8	38	14
Complete vagotomy without gastroenterostomy	3.0	0-18.3	13	4
Incomplete vagotomy	2.7	3-18.5		3

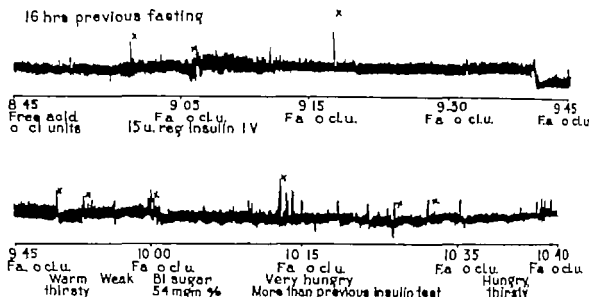


Fig 6 Postoperative insulin test Motility tracing showing no spontaneous or insulin induced hunger contractions following complete vagotomy

decrease of 72 per cent. In all 11 cases of complete vagotomy a decreased secretory response to histamine was noted, and in 2 an achlorhydria was present.

#### 4 The Effect of Caffeine

**Method.** The method employed was that of Roth, Ivy and Atkinson. After the determination of basal secretion 0.5 gram of caffeine with sodium benzoate in 200 cubic centimeters of water was given through the Levine tube. Aspiration of the gastric contents was resumed  $\frac{1}{2}$  hour later and continued for 2 hours unless the secretory rate had returned to or below the basal level at the end of  $1\frac{1}{2}$  hours.

**Results.** Figure 3 is a composite curve demonstrating the secretory response of the stomach to caffeine before and after complete vagotomy. The average secretory response in 12 patients was 7.2 milliequivalents per hour

before surgery and 1.0 milliequivalent per hour after complete vagotomy, a decrease of 86 per cent. In all 12 cases of complete vagotomy a decreased secretory response to caffeine was noted, and in 3 an acidity was present.

Before vagotomy 7 patients showed an ulcer type response to caffeine. Following complete vagotomy 4 of these had no response to caffeine, 1 a normal curve. Before surgery 4 patients had a normal response. After complete vagotomy 3 of these had an ulcer type curve although only a slight response, and 1 had no response.

#### 5 The Effect of Atropine on Basal Secretion

**Method.** After the basal secretion had been determined, an intramuscular injection of 1.2 milligrams of atropine sulfate was given and the effect on basal secretion noted (14, 16, 20).

**Results.** Before vagotomy the free acid was reduced to zero following the injection of

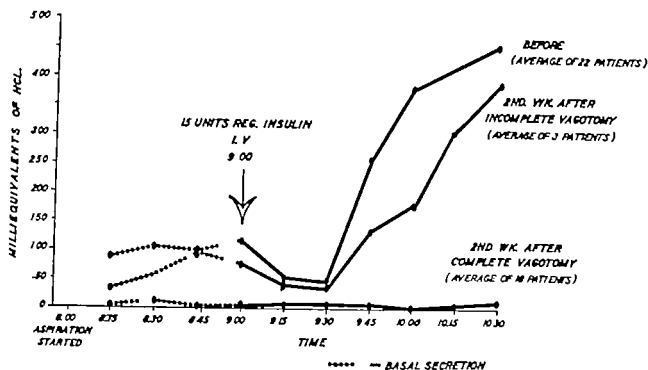


Fig. 7 The effect of insulin on gastric acidity before and after vagotomy

atropine in 7 of 11 cases (Fig 4) Following complete vagotomy the basal secretion of free acid was usually zero thus the effect of atropine could not be ascertained

#### 6 The Spontaneous Motility of the Stomach and the Effect of Insulin on Gastric Secretion and Motility

**Method** After the determination of the night secretion at 8 a.m., a second Levine tube with a rubber balloon attached was passed into the stomach. The balloon capacity was about 200 cubic centimeters but in order to avoid mechanical stimulation only 10 to 50 cubic centimeters of air were used in the balloon during the test. The balloon was placed in the cardiac end of the stomach and its position confirmed by inflation and gentle withdrawal of the attached tube until there was a slight tug as the balloon reached the cardiac sphincter of the stomach. By this means it was assured that the balloon was not in the pylorus where it may cause mechanical stimulation. The balloon was then only partially inflated and connected to a water manometer. Continuous recordings of gastric motility were made on a slowly moving kymograph.

A control period was then observed for at least 1 hour of basal secretion and motility the gastric secretions being aspirated through the

first tube as in the preceding tests. Then 14 to 16 units of regular insulin were injected intravenously and the effect on gastric motility and acidity noted for 1½ to 2 hours.

A review of the literature and detailed discussion of this subject have been previously reported (32).

**Results** Before vagotomy the motor response to insulin hypoglycemia was determined in 27 patients. All of these patients showed spontaneous Type I and occasional Type II and III hunger contractions (Fig 5). Following the insulin injection there was an immediate suppression of hunger contractions lasting ½ to 1½ hours and usually followed by a period of hypermotility. At the height of the hypoglycemic reaction there was a sudden marked increase in the free acid. The average preoperative secretory response in 22 comparable patients with duodenal ulcer is shown in Figure 7.

Following surgery 3 patients had a marked acid response to insulin hypoglycemia (Fig 7) and are therefore classified as cases of incomplete vagotomy. These patients also had either spontaneous or insulin induced hunger contractions postoperatively.

The remainder of the patients had no acid response to insulin hypoglycemia and are considered to be cases of complete vagotomy.

These patients had no spontaneous hunger contractions in the fundus of the stomach after 16 to 22 hours of fasting and no hunger contractions following insulin hypoglycemia (Fig 6)

The ravenous hunger often produced by insulin hypoglycemia is present following complete vagotomy (13)

In 9 cases an attempt was made to determine gastric tone before and after complete vagus section. One to 100 cubic centimeters of air were placed in the balloon and the intra gastric pressure recorded from the manometer in centimeters of water. A series of readings was taken before and after vagotomy. The results were equivocal.

#### 7 *The Pain Threshold to Electrical Stimulation*

**Method** The procedure of Boyden and Rigler was used. A wire was threaded into a Rehfuess tube and attached to the metal olive. This served as the active electrode when placed in the stomach. An indifferent electrode was placed on the back or thigh. The electrodes were attached to a Harvard inductorium supplied by two dry cell batteries.

**Results** The minimum current necessary to produce sensation in the region of the stomach was noted in 7 patients before and after vagotomy. The results were equivocal.

#### 8 *The Production of Pain by the Introduction of Acid into the Stomach*

**Method** The procedure of Palmer was used. 200 cubic centimeters of 0.5 per cent hydrochloric acid was instilled into the stomach by means of a Levine tube. If no pain was produced the test was repeated in 1/2 hour.

**Results** In 3 of 7 patients in whom tests were made the acid produced typical ulcer pain before surgery. In 1 of these pain was produced after complete vagotomy. This was in a patient with marginal ulcer. On the first and second postoperative day no pain was produced. On the third day x ray examination revealed that the Levine tube had passed through the gastroenterostomy. The tube was pulled back into the stomach and the acid test repeated with the production of ulcer pain within 5 minutes. The other patients in whom

tests were made had duodenal ulcers, moderate to severe pyloric obstruction and delayed gastric emptying. At surgery both a vagotomy and gastroenterostomy were performed. It is questionable whether the acid reached the ulcer after operation.

#### DISCUSSION

The secretory activity of the stomach may be divided into the period of interdigestive or continuous secretion and the digestive period of secretion. The latter consists of three phases: the cephalic, the gastric, and the intestinal (1, 15, 29).

Gastric secretion during the interdigestive period may be due to either humoral or nervous factors or to both. Dragstedt has stressed the possibility that the hypersecretion of duodenal ulcer is due to constant excessive activity of the gastric secretory fibers in the vagus nerves (8). The marked diminution of the night secretion and basal secretion following complete vagotomy indicates that the vagus is the most important factor contributing to gastric secretion during the interdigestive period. The secretion of acid during this period is not abolished by complete vagotomy; thus the vagus is not the only factor concerned. In addition, the lowering of night secretion and basal secretion may be due to a decreased responsiveness to circulating stimuli.

The cephalic phase of gastric secretion is mediated entirely by the vagi. The gastric phase of secretion can be provoked by mechanical stimulation and secretagogues, and has been considered independent of the vagus. In view of the marked decrease in the secretory response to histamine and caffeine following complete vagotomy, it is apparent that the gastric phase of secretion is to some extent influenced by the vagus.

A synergistic action of histamine and cholinergic drugs has been demonstrated (9, 24). Grossman has suggested that the responsiveness of the gastric glands to all types of stimuli may be dependent upon the basal level of acetylcholine production in the stomach (12). This would explain the decreased action of secretagogues following complete vagotomy.

It should be stressed that in our studies, the secretory response to chemical stimuli was

reduced in every patient in whom the insulin test indicated that vagotomy was complete. After incomplete vagotomy with gastroenterostomy the response was often slightly decreased. After incomplete vagotomy without gastroenterostomy the secretory response to chemical stimuli was essentially unchanged being sometimes slightly decreased and occasionally somewhat greater than the preoperative value. We feel that it is probable that the inconsistent results reported by other workers may be due to failure to distinguish between completely and incompletely vagotomized subjects. The excellent correlation which we have found to exist between a negative post operative response to insulin (indicating complete vagotomy) and depression of the secretory response to histamine and caffeine constitutes strong confirmatory evidence of the reliability of the insulin test when properly performed as an indication of the completeness of vagotomy.

The fact that complete vagotomy is followed by immediate relief of ulcer symptoms and apparent healing of the ulcer does not prove that excessive vagal activity is the cause of peptic ulcer. Both periods and all phases of gastric secretion are either partially or completely dependent upon vagus function. Complete vagotomy interrupts a mechanism necessary for chronicity of peptic ulceration although this mechanism may not be primarily disturbed.

Eight patients were tested 3 to 9 months after vagotomy. In 7 of these there was no evidence of return of gastric function to the preoperative level. One patient showed a return of vagus function after 9 months as demonstrated by the insulin test. The response in this case to the other tests was similar to the immediate postoperative values. Vanzant reported in the dog a return of gastric acidity to near normal 2 years following vagotomy. The late effects of complete vagotomy on the gastric secretory and motor function in man are not yet certain.

The determination of basal secretion is an excellent method for the study of the interdigestive period of gastric secretion. It is easier to determine the basal secretion than the night secretion and the results are equally accurate.

In addition the basal secretion serves as a control for the study of the action of stimulants or depressants on gastric secretion.

### CONCLUSIONS

Following complete vagotomy there is a marked reduction of the night secretion and the basal secretion. The secretory response of the stomach to caffeine and histamine is greatly reduced.

Insulin hypoglycemia produces an increase in gastric secretion and usually motility. This action is abolished by complete vagotomy. There are no spontaneous hunger contractions in the fundus of the stomach up to 9 months following complete vagotomy.

The vagi are the sole mediator of the cephalic phase of gastric secretion. They are the most important factor concerned in the interdigestive period and a contributing factor in the gastric phase of secretion. Complete vagus section in some manner interrupts a mechanism necessary for chronicity of peptic ulceration.

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# CERVICAL CYTOLOGY KEY TO DIAGNOSIS OF EARLY UTERINE CANCER

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Of all the research work which is being done in gynecology in general and in cancer of the female genital tract in particular there is little of such great importance or of such paramount value to the practicing physician as that work which is directed toward the study of the cells of the female genital organs. While the applications of this technique are many and varied its most important function at the present time is concerned with the early diagnosis of pelvic malignant neoplastic activity. By the study of the cells contained in the secretions of the genital tract of the woman an accurate indication of the growth activity of her organs can be obtained. The use of the vaginal and cervical cytology tests in the diagnosis of cancer of the pelvic organs has now been extended to every doctor who can use a speculum and has the facilities provided by the government mails. It is now possible by the use of a specific technique to mail slides to specialized cytology centers where they are quickly stained read and the report sent out by way of the most rapid route.

A few words concerning the basic principles of this method may be in order at this point (1). Most of the genital epithelium in the female arises from the muellerian ducts and it possesses the characteristic property of the muellerian tissue namely that of desquamation. This means that the surface cells are slowly cast off and pass down through the tubes corpus of the uterus, and cervix and finally come to rest in the vaginal pool where they are mixed with the secretions of the vagina itself. Thus we find in the vaginal pool a conglomeration of cells from all parts of the female genital apparatus. Shields Warren quotes Dale Rex Coman who found that cells of carcinoma of the cervix could be separated

with less than one-sixth of the force required to separate normal epithelial cells of the cervix. This being the case not only is cancer of the uterus an exfoliative lesion but the desquamation from these growths proceeds at a much faster rate than that from normal tissue. Cells detached from the surface of the tumor fall into the lumina of the uterus and vagina, where they become mixed with the desquamated cells of the normal epithelium (11). The process is a kind of natural curettage going on without interruption and always providing fresh and easily obtainable material for study.

If the above mentioned properties of the normal and malignant genital epithelium really exist then the cancer cells should be identifiable in the vaginal secretions. That this is the case was proved conclusively by Papanicolaou and papers covering this phase of his work were published in 1928 (12) 1933 (13) 1943 (16) etc. This work was corroborated by Ayre in Montreal and by Meigs and Graham working in Boston. Papanicolaou's original technique (17) consists in drawing the secretions from the posterior fornix of the vagina into a pipette fitted with a rubber suction bulb. This secretion is then transferred to a clean glass slide where it is spread evenly. The slide is then placed into an ether alcohol mixture for fixation. After they are stained by a specialized method, mounted and dried the slides are ready for examination.

During the course of his manifold investigations Ayre found that smears taken directly from the os of the cervix were a more efficient means of diagnosis than those taken from the vagina (1, 2). The reasons for this are logical and easy to understand. The majority of genital malignant conditions arise from the uterus either the fundus or the cervix. There is at the cervical os a variable amount of thick sticky mucus. Therefore a greater con-

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centration of malignant cells will be found in this mucus than will be present in the vaginal pool. The cancer cells are in this way picked up before they are diluted by the not inconsiderable vaginal fluid. A second significant advantage of the cervical as opposed to the vaginal smear lies in the fact that the cells are aspirated directly from the squamocolumnar junction of the cervix the precise area where epidermoid carcinoma of the cervix has its origin. In this way not only the late full blown cases of cancer are found but the early lesions which were being missed previously may now be detected while they are still in a curable stage.

Some workers (9) agree that in some instances the cervical smear may be of greater value than the vaginal smear. They believe that such situations are few in number and believe that in the cervical method one of the greatest assets of the vaginal technique is lost namely its simplicity. The cervical method requires the insertion of a speculum into the vagina before the smear can be taken something which is not done when the older vaginal technique is employed. This then is the reason for the belief that the vaginal cytology smear is to be preferred to the cervical one. The validity of this line of reasoning is open to serious doubt and question. We admit that the taking of the cervical smear involves the use of a slightly more detailed technique but doubt that this is of any significance whatever. We are not interested at this point to stress the advantages of the cervical method from a cytological standpoint. Our reasons for preferring this technique are much more fundamental in character. To any physician who practices gynecology either as a specialty or as a part of general practice the insertion of a speculum should not constitute a problem. It is an extremely simple procedure which takes no longer than a couple of minutes, a small price to pay in order that the cervix may be subjected to careful scrutiny. Many articles are being written today about the delayed diagnosis of cancer of the cervix. Much blame is heaped on the members of our profession who treat abnormal vaginal bleeding and other female complaints without first doing a pelvic exami-

nation. I think we all agree that this is a pernicious practice which must be abolished. What competent gynecologist would dare dismiss a possible cancer case from his office before he had done a complete pelvic examination? And what woman may not be harboring an unsuspected cancer in her uterus? The cytology test is a wonderful diagnostic aid, but we must never allow ourselves to lean so heavily on a laboratory test that we neglect the clinical aide of the picture. Hence we fail to see the logic in the belief that the cervical cytology test is inferior because it necessitates the use of a speculum with subsequent visualization of the cervix. Rather this is a distinct advantage. If the cervical cytology test never accomplishes anything more than getting all practitioners to perform pelvic examinations (digital and visual) on each and every one of their female patients, then it will still have been responsible for a great forward step in the fight for early diagnosis of uterine cancer.

The simplicity of the technique of taking the cytology smears is truly remarkable. The procedure must however be carefully and painstakingly carried out with full attention being given to detail. If this is not done the slides will be of inferior quality and the diagnosis will be more difficult to make. A very short summary follows.

The smear from the external os is taken with the aid of a bivalve vaginal speculum (Grave's modification of Sims' instrument) (3). The patient is placed in the lithotomy or dorsal position. No digital examination may be performed before the smears are taken. The patient should be advised against douching or other vaginal manipulations before coming to the office for the test. The speculum is inserted in the usual manner except that little or preferably no lubricating material is used. The lubricant may interfere with the staining reactions. The cervix is then adequately exposed and careful visual examination is performed. A glass pipette which must be clean and dry is used to aspirate the secretions from the external os of the cervix. The secretion including the mucus where many significant cells are trapped is transferred to one or two clean glass slides. The secretion is spread out as evenly as possible and the slides which

must never be allowed to dry are quickly immersed in the fixing solution. This solution is made up of equal parts of ether and 95 per cent alcohol. The slides are left here for at least 1 hour although they may remain in the fixer for as long as 2 weeks without undergoing any deterioration. After the slides are fixed they are removed from the fixing solution and without being allowed to dry, they are stained by the method after Papanicolaou washed in alcohol and xylol, and mounted in Canada balsam or similar substance.

One important fact needs to be emphasized again and again. Accurate study and diagnosis of the cytology smears can be done only by an expert. Even gynecologists and pathologists have indicated their inability to interpret cytology tests without the essential preliminary study of a large group of normal cases and positive cancer cases. Every doctor spends at least a year in training in pathology before attempting to interpret cancer from tissue biopsies. Cytology is equally exacting and demands adequate training in cell study before experienced judgment may be developed. It is unfortunate that men with training in neither pathology cytology nor laboratory techniques are attempting to do this work. The inevitable errors caused by poor staining as well as inadequate interpretation have resulted. The method has thus undeservedly fallen into disrepute in the minds of many doctors and consequently many women are denied the benefits of this remarkable diagnostic aid.

The average practitioner may say. Fine the cytological diagnosis of early cancer may well be an important advance in medicine—but only for the expert cytologist and gynecologist. What I want to know is of what help can it be to me—far from any large medical center to which I can send my patients to have these tests performed? These tests are for the benefit of every practicing physician and we shall in a few words show how anyone can make this diagnostic method available to his patients.

It will be obvious that every doctor cannot become an expert cytologist. Hence the procedure of choice is to have in each province, state or district a central laboratory manned

by a group of cytologists and technicians well trained in this work. The slides must not be allowed to dry and the apparent difficulty in mailing the cumbersome jars filled with the ether alcohol solution was soon recognized. It was a major obstacle. To obviate this difficulty Ayre and Dakin have worked out a method by which the slides may be mailed almost any distance in a neat compact and simple fashion. A description of this important technique is now given.

#### GLYCERINE MAILING TECHNIQUE OF AYRE AND DAKIN (5)

After standing in the ether alcohol fixer for 1 hour or more the slides are removed from the solution. Without permitting them to dry a large drop of glycerine is placed in the center of the secretion zone. A second *clean* slide is placed face to face with the smear and the glycerine spreads out to cover the entire smear area sealing it off completely. It must be noted that each unit is made up of two slides (1) the slide with the smear on it and (2) a clean slide acting as a cover slip. The slides are then placed in wooden or cardboard containers to prevent breakage and are mailed to the cytology laboratory. Airmail is preferable. The slides may remain in the temporary glycerine mounting for 2 weeks if necessary, but the best results are obtained if this does not exceed 1 week. Once the slides arrive at their destination the glycerine is washed off and the usual staining routine is carried out. Experimental study of both normal and cancer cells have shown no deterioration of cellular detail or staining qualities.

We see therefore that the use of this diagnostic test is not confined to the gynecological specialists in the large cities. Any doctor with the ability and interest to insert a speculum into the vagina of his patient can take the smears. The mailman brings the cytology laboratory to the physician's front door.

It was with considerable interest and some dismay that I noticed in an abstract of an article (10) on cytology the following as the final paragraph. This method is not an office procedure; it should be interpreted by those trained in cytology and in the smear method of making a diagnosis. Unfortunately any

one who is not familiar with the cytology smear technique might take this misleading statement literally. With the second part of this paragraph we agree heartily. It is an irrefutable fact that without the proper training and experience these smears cannot be accurately studied and interpreted. The first sentence makes a positive statement with which we must disagree, and to which we must strongly object. Cytology is an office procedure. This is the cornerstone upon which the whole structure of the cytological method in cancer detection stands. Remove this and the collapse of the system is inevitable. One need not be an expert to take these smears. Once he has been shown the technique any practitioner can use this method. He does not need specialized training because he is not required to stain and read these slides. Every physician makes wide use of the blood test. Yet how many really understand the diagnostic technique or the serological basis of this procedure? We need and shall have more central laboratories to which the physicians can send their smears for staining and interpretation. It cannot be stressed too strongly that cytology is an office procedure which every doctor can and should use routinely.

While the vaginal and cervical cytology smears, as obtained by the method of aspiration with a glass pipette have given excellent results in diagnosing cancer it must be realized that this technique collects dead cells that have already been desquamated from the growth and have been lying in the vagina or at the os for some time. Search has been made for a method to detect the earliest cellular changes in malignancy and the precancerous state. It has long been known that more cancer develops at the junction of the columnar epithelium of the cervix with the squamous lining of the portio than at any other single focal point of the uterus. Hence a technique which is aimed at the detection and study of the earliest malignant changes in the squamous cells must of necessity procure cells from this region. In April of 1947 Ayre published a paper (4) describing the development and use of the "spatula cytology technique." Previous methods consisted in the aspiration of cells which had already been desquamated.

The spatula technique is a means of collecting the cells before their exfoliation. In this way younger cells are obtained and earlier malignant changes can be recognized than was possible by the use of the older methods. By using this new method of collection the cells are obtained while in a state of excellent preservation before they have become shrunken or the clarity of their cellular detail obscured. Since every cancerous growth is characteristically friable be it in the invasive or pre-invasive stage large numbers of cells (cancer juice) (7) will be obtained when such tissue is gently scraped. In this way an excellent "surface biopsy" is obtained.

In common with all cytology smear techniques, the spatula smear is easy to take, but proper interpretation requires their study by an expert cytologist familiar through practice with the cell types scraped from this area. The first step in the routine cytology test concerns itself with the aspiration of the mucus and secretions from the external os, and their transference to the glass slides. Once this part of the test has been completed the spatula method comes into play. Use is made of a small specially formed wooden spatula to scrape the entire circumference of the squamocolumnar junction. It may be noted that the precise location of this juncture point varies as to whether or not an erosion is present. The spatula technique can be varied slightly to conform with the shape and condition of the cervix. The secretion obtained in this way is transferred to a glass slide which is immediately immersed in the ether-alcohol fixative. The staining is performed in the same way be the cells gathered by the aspiration or the spatula method.

By obtaining routine cytology smears on all patients regardless of their individual complaints, a new cytological picture termed by Ayre the "precancer complex" has been noted (1-4). This group presents the following features: (1) anaplastic squamous cells showing considerable nuclear variability (2) cornified cells whose nuclei are abnormally large (3) multilobulation and splitting of the cell nucleus into several separate nuclei in the cornified and precornified cells (4) abnormally high cornification counts.

Ayre has come to recognize this picture as an indication that a precancerous condition is present. By this is meant nuclear change in the squamous cells at the squamocolumnar junction of a hyperplastic nature with no invasiveness. These lesions are definitely more than an erosion, and more than squamous metaplasia or epidermidization in an erosion, but they have not yet reached the stage of invasive cancer. This cytological picture has been found, and the presence of the lesion confirmed by careful biopsy, in patients who complain of nothing more than a whitish discharge, and whose cervixes may show only a tiny circular reddened area about the os. Were cytology smears not taken on these women the growths may not have come to light until a full blown, far advanced cancer had developed. Routine cytological examination of all females will undoubtedly reveal many early unsuspected, and what is most important, curable cases of uterine cancer.

It may be of interest at this point to mention some of the changes in the morphology of the cells which lead the trained observer to diagnose the presence of malignancy. The size and form of the nucleus are most significant (14). In malignant cells the nucleus is abnormally large in proportion to the size of the cell and the amount of cytoplasm. It tends to grow far beyond the normal limits and to acquire atypical forms. Its structure assumes a characteristic pattern with intensely stained granules or small clumps of chromatin, and a distinct network of filaments centering in the nucleoli. Actual mitoses are rarely seen. The nuclei show considerable variability. Often atypical fragmentation results in binucleate or multinucleate cells. The cytoplasm is usually basophilic. Abnormal vacuolization is a not uncommon finding. Grouping of these cells in clusters and crowding are points of diagnostic value. The cells may overlap to such an extent that it is not possible to focus them in one plane. One sometimes finds bizarre cells (17). These are more common in far advanced cases. Other elements which add to the picture but are in themselves not diagnostic, may be mentioned. These include blood cells, clumped leucocytes, histiocytes and a high degree of cornification.

Most of the discussion up to this point has been centered on cancer of the cervix. Cancer of the endometrium can just as well be diagnosed by the cytology method (9). Here the same problems are encountered but interpretation may be more difficult because there is often less difference between normal and malignant endometrial cells. Hence the diagnosis of cancer of the fundus calls for more expert interpretation than does cervical carcinoma. That the diagnosis of endometrial cancer can be made with a high degree of accuracy has been proved over and over again by several workers (8-14). The endometrial malignant cells do not show the high variability displayed by the modified squamous epithelial cells found in cancer of the cervix. They are considerably smaller and their variations in form and size are limited. The most frequently found cell types have a cuboidal columnar or spindle-like form and appear singly or in dark staining clusters which can be spotted with the low power. The nuclei are hyperchromatic, enlarged and show variations in size and shape. Histiocytes are as a rule numerous and blood and pus cells are found as in the cervical lesions. It must be remembered that the endometrial cells seen in the cytology smear are desquamated cells and in their journey from the uterine fundus may undergo shrinking or distortion. In cases of doubt the use of a cannula to obtain smears directly from the cavity of the uterus may be of considerable help in arriving at a diagnosis (15).

It has been noted that the spatula cytology technique is selective in cases in which there is invasive and preinvasive cancer. There is also a method which is selective in cases of endocervical and endometrial carcinoma (14). The technique is essentially quite simple. Use is made of a special cannula to which an ordinary glass syringe is attached. The cannula is first inserted into the endocervical canal and the cells are aspirated into the syringe. These are blown onto a glass slide which is placed in the ether alcohol solution. The cannula is then inserted directly into the uterine cavity and secretion from this region is obtained in the same way. The fixing and staining are carried on in the same fashion as for the vaginal and

cervical cytology smears. It is advisable that in cases in which many glandular cells are noted in the vaginal smears the endocervical and the endometrial smears be taken to rule in or out the presence of an endocervical or endometrial cancer.

The following is a representative case of cancer of the body of the uterus which was discovered through routine cytological examination.

Mrs. C. White, widowed 75 years of age came to the gynecological out patient clinic with the complaint of vaginal spotting for the past 3 years. She had consulted her family doctor several times and had been given some injections. Since the spotting persisted she was referred to the clinic. Physical examination revealed a fairly well nourished woman of stated age. Pelvic examination was essentially negative. The cervix was surprisingly clean and healthy in appearance. The vagina showed atrophic changes. No uterine enlargement was noted she was permitted to go home. Routine cytology smears revealed the presence of many cells which were unmistakably malignant and suggestive of a glandular type cancer. Repeat smears next morning confirmed the original impression. The patient was admitted the same day. A dilatation and curettage under anesthesia revealed that the uterus was slightly enlarged and was full of tissue that had the gross characteristics of cancerous material. Microscopic diagnosis was papillary adenocarcinoma.

There are many crude methods of estimating the body estrogen level but none perhaps is more simple nor more accurate than the cornification count in the cytology smears. Studies by Ayre (1) have revealed new evidence of abnormal endogenous estrogen in both benign and malignant uterine neoplasia. Patients who had gone through the menopause exhibited abnormally high cornification counts in the vaginal and cervical smears. Many of these patients were later shown to have proliferative Swiss cheese hyperplastic, or retrogressively hyperplastic endometria. This again suggests that in castrates and postmenopausal women some organ other than the ovary (probably the adrenal cortex) takes over the production of some estrogenic substances. In women and in female monkeys the estrogens manifest their presence in the vaginal mucosa by cornification of the cells. This is accompanied by proliferation of the vaginal and cervical squamous epithelium. This growth change is related to the deposition of

glycogen in the squamous cell which is mediated and controlled by the force of the estrogenic stimulus. The vaginal epithelium of the average postmenopausal female is made up largely of basal cells which contain no glycogen and cornification is absent. Under the influence of estrogen the deposition of glycogen may be brought about and cornification of the squamous cells occurs, whether the patient be postclimacteric or following surgical castration. A practical use of this phase of the cytology smear is in follow ups of postmenopausal women who are receiving estrogenic therapy.

It may be noted in passing that the diagnosis of cancer by cytological methods is in no way confined to malignancy of the female genital tract (17). Cancer of the prostate, bladder and kidney has been diagnosed from malignant cells found in the urine. Cancer cells in sufficient number to make a diagnosis possible have been demonstrated in the sputum and pleural fluid of patients with cancer of the lung. In gastric cancer the malignant cells are found in the stomach washings. Much research remains to be done in these cancer types, but in uterine cancer the method has proved so reliable as to merit widespread application in cancer detection programs.

A positive smear is not an indication for radical treatment. Confirmation by immediate biopsy is mandatory. It means that cancer is present somewhere in the genital tract and it is the duty of the patient's medical attendants to rest not until the malignant lesion has been found and treated.

We should like at this point to present two illustrative cases which emphasize the value of cytology to the practicing physician.

Mrs. D. aged 70 years was brought in by her daughter for a routine check-up. She had no complaints. Routine cytology smears were positive. Biopsies of the cervix revealed the presence of a pre-invasive carcinoma. Had routine cervical cytology smears not been taken on this patient the lesion would not have been found until considerable growth and invasion had occurred.

Mrs. J. was only 35 years old when she consulted her physician, complaining of loss of weight, loss of appetite constipation and leucorrhea. Cervical cytology smears were positive. The first biopsy was negative, but when the cervix had been amputated and serial sections cut, the cancer was found.

This case is illustrative of the fact that cancer does occur in young women and that we should never omit careful investigation of a patient because she has not reached the so-called 'cancer age.

These 2 cases, one in an elderly woman and one in a young woman, are adequate evidence of the accuracy of the cervical cytology smear technique in diagnosing early preclinical curable cancer. Serial sections were necessary in one case before the cancer was revealed but if the cytology is positive and correctly interpreted cancer is there. The investigation must be continued until the lesion is found.

#### DISADVANTAGES

- 1 Specialized training is required in order to make an accurate interpretation (14)
- 2 The test does not show the grade of malignancy although it may occasionally give some hint as to the prognosis
- 3 It does not supply information as to the mitotic activity of the malignant cell or its relationship to the adjoining tissue
- 4 The type and origin of the malignant cell are not always clear

#### ADVANTAGES

- 1 The test is an unusually simple and painless office test (11)
- 2 It is relatively rapid (1) It can be taken stained and reported in a morning
- 3 It is inexpensive
- 4 It can be repeated as often as necessary without any harm to the patient. Thus it is of great value in follow ups of patients who have had irradiation treatment
- 5 No hospitalization is required
- 6 It permits diagnosis in relatively early stages even before the appearance of clinical symptoms. It also reveals the presence of carcinoma *in situ*
- 7 The characteristic modifications of nucleus and cytoplasm of the cancer cells are more apparent in the smear where the cells appear isolated than in tissue sections where they are in a crowded state
- 8 It is of tremendous value in the screening of large numbers of patients (9)
- 9 It is reliable in the hands of experienced men

10 It does not conflict in any way with the established methods of pathologic diagnosis such as biopsy or curettage (14). On the contrary it is a most valuable complement to them.

11 In the control of the menopause the cytological test has a significant rôle to play, giving immediate indication when irregular bleeding may be benign and when dangerous.

We have described the two main cytology smear methods used in gynecology today. The older vaginal method was first described by Papanicolaou in New York City. The cervical modifications were added by Ayre working in Montreal. The vaginal technique has the advantage of simplicity in the taking of the smear. The cervical method which necessitates the use of a speculum carries with it the advantages of more rapid interpretation of each slide as well as greater accuracy.

It is true that the cervical smear takes a little longer time in that a speculum must first be inserted into the vagina. We feel that this disadvantage if it can be so called is outweighed by the fact that a visual examination of the cervix may be done each time smears are taken and visual examination is after all an essential part of every pelvic examination.

The vaginal smear is taken from the pool in the posterior fornix. The cancer cells if there are any are mixed with the normal desquamated cells of the vagina, the vaginal fluid and the debris. Thus the secretion from the fundus and cervix of which the malignant cells are a part is diluted by the vaginal fluid. The cancer cells are separated from each other and appear in the vaginal smear as single cells. Not only are the single malignant cells difficult to spot but the considerable debris from the vagina tends to obscure the telltale cells. These factors often make it difficult to find the cancer cells and cause the interpretation of a single slide to be a long and arduous task.

The cervical smears on the other hand be they aspirated from the os of the cervix or scraped off with a wooden spatula, are obtained before the secretion from the uterus and cervix reaches the vagina. This leads to two important results (1) secretion is undiluted, the cancer cells appearing not singly, but in groups. (2) The obscuring effect of the vaginal

debris is eliminated. Since it is much easier to spot groups of cells than it is to find lone cells, interpretation of the cervical smears is easier and can be done more rapidly.

A further point must be considered. Since the majority of genital malignant lesions in the female arise from the uterus, be it corpus or cervix it is logical to assume, and it has been proved that the cervical method is more accurate than the vaginal one for the smear is taken from the squamocolumnar junction where most cancers of the cervix begin. Comparative smears from the same patient (with cancer of the cervix) show many more malignant cells in the cervical smears than were found in the vaginal slides.

We have briefly outlined a few of the reasons upon which we base our belief that the cervical cytology method is superior to the vaginal technique. It is a very simple matter when doing the test to take three smears: (1) Aspirate the mucus from the os using the usual standard pipette. (2) Scrape the squamocolumnar junction gently with the wooden spatula. (3) Take a vaginal smear using the original method. We feel that those physicians who follow this routine will be convinced by their findings in cancer cases of the superiority of the cervical cytology technique.

I doubt that a paper on cancer of the uterus has been written in which the author does not bewail the situation in which most cancers of the cervix are seen by the physician at an advanced stage when treatment is of small help. If we could get these patients at an early stage of the disease cures could be effected, what we need is some way of diagnosing this dread disease before it has grown into the ulcerating mass which sooner or later causes a hemorrhage that brings a terrified and often exsanguinated woman to the doctor's office. The vaginal tests and the superior cervical cytology tests do fill this diagnostic void. Every physician should learn to take the smears properly and should make their use an integral part of his diagnostic armamentarium.

Late tuberculosis is difficult to treat with much success while early tuberculosis is most amenable to treatment. The hope of the internist who years ago was continually faced with cases of young people dying of tubercu-

losis was that some method might be discovered whereby this dread disease could be discovered before those afflicted had reached the incurable stage. Routine x ray examination of the lungs of healthy persons has provided part of the solution. It must be remembered that a person with early but diagnosable tuberculosis, like the woman with very early cancer of the cervix is to all intents and purposes a healthy individual. No man or woman who feels well consults a physician. The disease is allowed to progress before medical aid is sought. The chest survey technique has obviated this difficulty. Since healthy people are examined it is obvious that many early cases will be found.

Were it not for the marvelous discovery of the Wassermann test for syphilis, we should see many more far advanced cases of generalized and neurosyphilis than we do. Today the "blood test" is a simple routine measure of protection which every enlightened doctor performs as a routine part of his examination, and which every intelligent patient both accepts and expects.

We feel that the cervical cytology test presents a fair analogy. In order to pick up cases of early cancer we must search for them among 'healthy' women. We must strive toward that ideal state in which every woman will have a periodic check up once or twice a year with the cytology test playing the important rôle which it so truly merits. It must be obvious that if this routine were followed by every woman and every physician, many early asymptomatic and unsuspected cases of cancer of the cervix would be brought to light at a stage where successful treatment could be provided. In this way the mortality from cancer of the uterus which on this continent accounts for well over 20,000 deaths yearly can be should be and shall be lowered.

#### SUMMARY AND CONCLUSIONS

A discussion is presented of the basic principles of the cytology tests and their application in the early diagnosis of cancer of the uterus.

The vaginal aspiration, the cervical aspiration and the cervical spatula techniques are described, and their relative merits discussed.

It is believed that the cervical spatula test is the most efficient in the diagnosis of very early cervical cancer.

Emphasis is placed upon the importance of having a central laboratory in each district where expert study of these smears may be made.

A simple and efficient mailing technique is described.

Great stress is placed upon the fact that these smears can be taken by every practitioner in his office. This combined with the mailing technique makes it possible for every doctor and every patient to reap the benefits of this modern diagnostic procedure.

A "precancer" complex is noted.

Some diagnostic features of smears in cases of malignant disease are described.

Cancer of the uterine fundus as well as cancer of the cervix can be diagnosed accurately by the cytology method.

These smears provide a reasonably accurate measure of endogenous body estrogen at any one time.

The advantages and disadvantages of the tests are presented.

It is concluded that the use of routine periodic check ups with cytology tests at each visit will do much to lower the present high mortality rate from uterine cancer.

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# ACUTE NON CLOSTRIDIAL CREPITANT CELLULITIS

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**A**CUTE non-clostridial crepitant cellulitis is an infrequent clinical entity characterized by a rapidly spreading emphysematous infection involving the skin and epifascial subcutaneous tissues accompanied by severe toxemia. Five cases in which adequate cultures showed no clostridia have been reported. Marwedel and Wehrsig reported 2 cases in 1915 which they attributed to the anaerobic streptococcus. In 1936 Howe reported another case following an appendectomy in which the crepitation extended to the neck, thigh and suprapubic area. Although it was considered to be a case of gas gangrene and was treated with polyvalent antitoxin, repeated cultures revealed no clostridia. Also in 1936 Meleney (7) reported the fourth example in which extensive gas formation was demonstrated clinically and by roentgenogram. His cultures revealed the presence only of the aerobic hemolytic streptococcus *Escherichia coli* and nonhemolytic anaerobic streptococcus. Terrell in 1940 reported the fifth case in which extensive crepitant cellulitis of lower abdomen, inguinal region and thigh originated from a perirectal abscess. Bacteriological studies showed anaerobic streptococcus and *Escherichia coli* the only bacteria present.

Associated with cellulitis crepitation may be caused by several factors which are outlined as follows:

- I. Extrinsic factors
  - A. Physical introduction of air by
    - Severe trauma
    - Improper irrigation of wounds
  - B. Injuries of respiratory organs
  - C. Chemical generation of gas
- II. Intrinsic factors
  - A. Infection by aerogenic bacteria
    - Clostridial bacteria
  - B. Other bacteria

The infected wound may possess gas introduced extrinsically by physical means such as

severe trauma, improper irrigation of wounds, and injuries involving respiratory organs, or by chemical generation of gas by such agents as hydrogen peroxide.

Rubenstein, Tabershaw and Daniels reported 3 cases with areas of subcutaneous crepitation about lacerations of the hand in patients who had handled an alloy containing 90 per cent of finely powdered magnesium. Schreus reported a series of 15 patients who developed crepitant and aseptic necrosis of muscle a few hours after the accidental injection of benzene thought to be typhoid vaccine.

Gas may be produced within the tissues by various aerogenic bacteria, the most frequent of which are the clostridia. Clostridial crepitant cellulitis characteristically occurs in the subcutaneous or retroperitoneal tissues and is also known as anaerobic cellulitis (4). Aerogenic bacteria other than the clostridia may also produce gas in subcutaneous tissues. These include 3 main groups: the coliform bacteria, particularly *Escherichia coli* and *Aerobacter aerogenes*, the anaerobic streptococci and various anaerobic gram negative bacilli of the *Bacteroides* group.

## MATERIAL AND METHODS OF TREATMENT

The small number of recorded cases and the confusion arising from the available clinical material concerning acute non-clostridial crepitant cellulitis have instigated this report. Of 12 proved cases which we have studied during the past 11 years, 3 patients were seen at the

TABLE I

Case No.	Age, years	Origin
	30	Perirectal abscess
	47	Abdominoperitoneal wound
3	48	Undetermined point in peritonitis
4	55	Peritonitis
5	50	Furuncle of thigh
6	49	Injury of right leg
7	37	Callus of foot
8	35	Thoracotomy
9	5	Injury to vulva
	43	Appendectomy wound
	35	Traumatic amputation of hip
	55	Hemiplegia wound

From the Department of Surgery, College of Medicine of the University of Cincinnati and the Cincinnati General Hospital. Presented at the Forum on Fundamental Surgical Problems, before the Clinical Congress of the American College of Surgeons, New York, September 8 to 11, 1947.

TABLE II

Case No.	Maximum temperature	Maximum w. b. c.	Maximum extent of cellulitis
1	107	600	Perineum, scrotum, inguinal area, flank
	103		Perineum, scrotum, inguinal area, lower abdominal wall
3	106	17,800	Perineum, scrotum
4	107.4	23,500	Deep fascial planes of neck and mediastinum
5	103	6,300	Entire medial aspect of thigh
6	104	47,000	Lower leg
7	102.8	00	Lower leg and foot
8	104	5,800	Thoracic wall
9	105	48,000	Vulva, abdominal wall, and right flank
	103.4	5,300	Abdominal wall and right flank
	103	1,000	Buttock, hip, abdominal wall
1	103.4	7,300	Inguinal area, abdominal wall, flank

Henry Ford Hospital and the remaining 9 at Cincinnati Hospitals. The lesion originated in the perineum in 4 instances, the lower extremity in 3, the inguinal and lower abdominal regions in 2 and the hip, the thoracic wall and the neck in 1 each (Table I).

In 8 patients, the infection complicated operative or accidental wounds. The areas involved in 9 patients were those easily contaminated by fecal, urinary, or respiratory tract discharges. In 7 instances, the patients were colored. The highest temperature was 107.4 degrees F and the lowest 101.6 degrees F with an average of 104 degrees. The white blood count varied between 6,200 and 48,000 with an average of 23,230 and a relative polymorphonuclear leucocytosis.

The youngest patient was 25 years of age and the oldest 59, the average being 45 years. Nine were males and 3 were females. Bacteriological studies showed the bacterial flora to be mixed in all cases, the average number of bacteria per case being 4.3. The incidence of the various aerobic and anaerobic bacteria is shown in Table III.

Among the aerobic organisms the nonhemolytic streptococcus and *Escherichia coli* were most frequently present, while of the anaerobic bacteria the *Bacillus melaninogenicum* and the anaerobic streptococcus were most frequent.

TABLE III

		1	2	3	4	5	6	7	8	9		
I. Aerobic												
A. Coliform bacteria												
	<i>Escherichia coli</i>	+	+	+						+	+	
	<i>Bacillus proteus</i>				+							
3	<i>Klebsiella fecalis</i>										+	
4	<i>Escherichia coli</i>							+				
B. Pyogenic cocci												
	Nonhemolytic streptococcus	+	+	+		+			+	+		
	Unidentified streptococcus				+	+		+				
3	<i>Streptococcus viridans</i>							+				
4	Hemolytic <i>Staphylococcus aureus</i>					+					+	
5	<i>Staphylococcus luteus</i>							+				
6	<i>Micrococcus</i>								+	+		
C. <i>Bacillus pseudodiphtheriae</i>								+	+		+	+
II. Anaerobic												
A. Cocci												
	Nonhemolytic streptococcus	+	+	+						+		
	Nonhemolytic staphylococcus								+		+	
3	Unidentified	+	+						+			
B. Bacteroides												
	<i>Bacillus melaninogenicum</i>	+	+	+		+	+	+	+	+	+	
	<i>Bacillus thetaiota</i>				+							
3	<i>Bacillus fragilis</i>	+										
4	Unidentified	+							+			
C. Non-sporulating bacilli												
	<i>Bacillus pseudodiphtheriae</i>		+									
1	Unidentified	+								+		

The treatment consisted primarily of early and radical incisions of the skin and subcutaneous tissue to points beyond the furthermost limits of the infection. Chemotherapy was used as an adjunct to surgery in 9 patients, 5 of whom were treated systemically with both penicillin and sulfadiazine, 3 with one of the sulfonamides and 1 with streptomycin. Postoperatively, zinc peroxide was applied to the diseased tissues as a creamy suspension in water or a stable ointment described by Reid and Altmeier (9) in the 8 later cases, while Dakin's or dichloramine T solutions were used in the 4 earlier cases.

The following case reports are given as examples of the nature of the condition as well as the course of acute non-clostridial crepitant cellulitis.

**CASE 7.** N. H., a 37 year old negro male who was a known diabetic, was admitted on February 18, 1944 with a history of an infected callus on the lateral aspect of the right foot of 1 week's duration. After the callus had been excised 7 days before admission, the wound became painful, swollen and markedly tender. Examination revealed an acutely ill adult negro male whose temperature was 102.6 degrees F, pulse 96 and respirations 26. There was a deep ulcer of the lateral aspect of the right foot which exuded foul-smelling pus, and the entire foot and lower one-third of the leg showed marked edema and redness. Lymphangitic streaks were easily visible to a point above the knee. His white blood count was 32,150 cells per cubic millimeter, red blood count 3.03 million and hemoglobin 13.0 grams.

On the day after admission incision and drainage of the involved area was done, and a large amount of gas was found in the grayish black subcutaneous tissues about the ulcer (Fig. 1). Postoperatively the wounds were irrigated with Dakin's solution every 3 hours and the patient was given penicillin and sulfadiazine systemically. Smears made of the pus showed numerous streptococci but no bacilli and cultures revealed the presence of aerobic nonhemolytic *Staphylococcus albus*, *Streptococcus viridans*, *Bacillus pseudodiphtheriae* and *Escherichia coli* as well as the anaerobic *Bacillus melaninogenicus* and *staphylococcus*. Two days after operation the crepitation had extended 6 to 8 inches above the malleoli (Fig. 2) and that the signs of toxemia had increased. Believing the infection to be an uncontrollable gas gangrene, his surgeon did a guillotine amputation at the level of the mid thigh on March 3, 1944. Examination of the amputated leg showed the subcutaneous tissues to be edematous, grayish black in color and crepitant up to the knee, but the muscles were not involved. Cultures of the pus showed the same organisms as before except the anaerobic *staphylococcus*. Immediate and striking improvement occurred following operation.

**CASE 9.** R. J., a 25 year old colored female, was admitted to the hospital on January 18, 1945 with painful swelling of her right labia and a history of having fallen astraddle a fence 3 days previously. Two days before admission she began to have a dull aching pain in the right lower quadrant, but there were no other symptoms suggestive of intestinal or genitourinary tract injury.

Examination showed an acutely ill and toxic colored adult female whose temperature was 104 degrees F, pulse 120 and respirations 28. There was extreme tenderness over an area extending from the right labia to the level of the anterior superior iliac spine. The right labia was markedly swollen and painful. Bilateral adnexal tenderness was also elicited on pelvic examination. The white blood count was 43,800, hemoglobin 13 grams, and urinalysis essentially normal.

A diagnosis of acute cellulitis was made and conservative therapy with massive hot compresses and sulfadiazine grams every 4 hours was started.

Within 24 hours the tenderness and induration spread rapidly to involve the entire right side of the abdominal wall and flank extending both anteriorly and posteriorly to the midline. At this time crepitation was present. She was given 300,000 units of penicillin parenterally in the next 24 hours, followed by 15,000 units every 3 hours. No further extension of the infection occurred but her temperature and pulse rate remained high (Fig. 3). A draining sinus developed in the right labium minus on the second hospital day. Although there was no extension of the process there was also no definite recession. On the 9th hospital day an extensive curved incision was made through the skin, and subcutaneous tissues including Scarpa's fascia from the region of the 5th dorsal vertebra posteriorly to the symphysis pubis anteriorly. The wound was irrigated with saline, packed with gauze and a dressing applied, incorporating tubes for irrigation with Dakin's solution. Following operation, improvement in her condition was rapid (Fig. 3). Culture of the wound showed non-hemolytic streptococcus, *Micrococcus flavus*, and *Bacteroides melaninogenicus*. Blood cultures were repeatedly negative. The dose of penicillin was reduced to 10,000 units every 3 hours 3 days after operation and was discontinued 7 days after operation. On February 28, 1945 a split thickness skin graft of the postage-stamp type was done successfully and she was discharged on April 19, 1945 after 92 days of hospitalization.

**CASE 10.** E. H., a white male of 43 years of age, was admitted to the hospital on March 2, 1945 with a history of right lower quadrant abdominal pain and tenderness of 2 days duration which was preceded by periumbilical pain and followed by nausea. Examination was essentially negative except for tenderness, rebound tenderness, and moderate spasm in the right lower quadrant. His temperature was 103 degrees F and his pulse 100. An appendectomy was done on March 30, 1945 through a McBurney incision by another surgeon. On the second postoperative day his temperature rose sharply to 103.4 degrees F and it was noted that the wound showed signs of infection. Penicillin in small doses of 10,000 units every 3 hours had been given intramuscularly during the preoperative and postoperative period. Five grams of sodium sulfadiazine were given intravenously on the second postoperative day and the wound was reopened for drainage. The patient also developed a marked ileus which was treated by continuous gastric suction. Supportive therapy with intravenous infusions of physiological saline and 5 per cent glucose in water solutions were given, but the infection of the abdominal wall extended rapidly and his condition grew considerably worse.

When seen in consultation on March 26, 1945, he was found to be desperately ill, markedly dehydrated, and moderately distended. His temperature was 102 degrees F, pulse 100, and respirations 30. The appendectomy wound was obviously infected. An area of crepitant cellulitis surrounded the wound and extended inferiorly to a point just below Pou-



Fig. 1. Illustrating the grayish black discoloration of the involved subcutaneous tissues in Case 7. Cultures revealed a mixed bacterial flora including the *Bacillus melaninogenicum* and anaerobic staphylococcus.

part ligament, medially to the midline and laterally into the flank and superiorly to the lower limits of the axillary region. This obviously represented an extension beneath Scarpa's fascia. The overlying skin was intact and showed exquisite tenderness, erythema and edema. The white blood count was 15,300 cells per cubic millimeter with 95 per cent polymorphonuclear leucocytes and the red blood count was 3,200,000. Urinalysis was essentially normal. Cultures taken of the necrotic slough showed the presence of the nonhemolytic streptococcus *Escherichia coli*, *Bacillus melaninogenicum* and the anaerobic streptococcus. A diagnosis of acute non-clostridial crepitant cellulitis of the abdominal wall was made and radical incision and drainage of the cellulitic area was done after preliminary preparation of the patient by adequate hydration and transfusion of blood. The subcutaneous tissues were found to be grayish black in color and crepitant containing a thin malodorous discharge. The operative wound was dressed with topical applications of zinc peroxide ointment covered by layers of moist absorbent cotton and vaseline gauze. In addition continuous gastric suction, interval doses of prostigmine, and injections of 20,000 units of penicillin intramuscularly every 3 hours were used. Supportive therapy was continued postoperatively and the appearance of the wound rapidly improved under daily dressings with zinc peroxide ointment. During his hospital stay he received 5,000 cubic centimeters of whole blood by transfusion. He was discharged on May 17, 1945 with his wound almost healed.

CASE 12. R. B., a 58 year old white male was admitted on May 19, 1946 for operative repair of a strangulated recurrent left inguinal hernia. This was associated with cramping abdominal pain, vomiting and constipation. Previously he had had a bilateral hernioplasty in 1925, a right hernioplasty in 1930, and a left hernioplasty in 1933.

Examination revealed a middle aged white male who appeared to be acutely ill and in distress. His



Fig. 2. Roentgenogram demonstrating gas in subcutaneous tissues of right lower leg in Case 7.

temperature was 98.2 degrees F, pulse 96 and respirations 22. Other findings were within normal limits except for bilateral inguinal scars and a firm tender mass measuring 5 by 10 centimeters over the medial third of the left inguinal ligament. Peristalsis was hyperactive. The white blood count was 8,600, hemoglobin was 11.5 grams and urinalysis essentially normal. Roentgenograms of the abdomen indicated small bowel obstruction.

A diagnosis of strangulated femoral hernia was made and operation on the day of admission revealed a small Richter's hernia which was strangulated in a femoral sac. The bowel was markedly cyanotic but viable. Twelve hours after hernioplasty his temperature rose to 100.4 degrees F. The wound became markedly tender and subcutaneous crepitation was noted at the superior angle. On May 23, 1946 the operative wound was reopened and radical incision and drainage of the surrounding cellulitic area was done. The skin was undermined throughout the full extent of the infection and the incision carried into the adjacent normal tissues. The subcutaneous fat over the left abdominal wall was found to be grossly infected, gray, malodorous and necrotic to the level



buttocks hip, thorax or neck which are easily contaminated by discharges from the intestinal genitourinary, or respiratory tracts. The infection usually developed when invasion of the subcutaneous tissues occurred either primarily from contamination of an operative or accidental wound or secondarily from pre-existing localized infection. The process extended rapidly and superficially over wide areas of the body usually without involvement of the structures beneath the deep fascia. Since the process arose so frequently in the perineum the route of spread was by direct extension beneath Scarpa's fascia into the inguinal region, abdominal wall and flank. The presence of areas of pre-existing necrosis or foreign bodies seemed to favor its development and spread.

The essential pathology was a wet inflammation of the subcutaneous tissues which progressed to necrosis with crepitation within 2 to 5 days after the onset. In those cases in which *Bacillus melaninogenicum* was found the subcutaneous tissues usually presented a grayish black color. Thrombosis of the nutrient vessels of the skin was a prominent finding histologically.

No single type of etiological agent was consistently present and several groups of bacteria seemed to be capable of producing this lesion. The various types of organisms suggested that a symbiotic or synergistic relationship is active in the process. The non-clostridial bacteria which apparently were capable of causing the infection under certain conditions included some strains of the coliform group particularly *Escherichia coli*, the anaerobic gram negative bacilli of the bacteroides group such as *Bacillus melaninogenicum* and *Bacillus thetoides* and the anaerobic streptococcus. In other cases which were similar clinically, cultures revealed the same mixed type of flora in addition to *Clostridium welchii* or one of the other clostridia. These were not included in this report although it seemed doubtful that the clostridia contributed to the severity of the process. It has been impossible to prove by animal experimentation that the anaerobic streptococcus or *Bacillus melaninogenicum* are the causal bacteria since they have been uniformly avirulent for experimen-



Fig. 4. Illustrating the area involved by subcutaneous necrotic infection and the extent of the surgical incision used in Case 2.

tal animals in our experience. However there is strong presumptive evidence that these organisms are virulent for human beings (1). The fact that some members of the coliform and bacteroides groups are pathogenic and gas producing in experimental animals however has been established and there is experimental evidence of marked synergistic activity of groups of intestinal bacteria (2, 3, 8).

The first symptom was pain which usually persisted or developed in and about the wound. Within 24 hours there was an elevation of temperature to 101 to 104 degrees F with a corresponding increase in the pulse and respiratory rates. The pain preceded by 1 to 3 days any obvious swelling or erythema of the overlying skin. As the cutaneous swelling progressed the pain increased, exquisite tenderness to the slightest touch developed and crepitation became perceptible. Early in the infection the patient's general condition frequently appeared to be good but as the lesion extended marked evidence of toxemia became evident with dehydration, temperatures as high as 105 to 107 degrees F, a weak and thready pulse and prostration. The white blood count increased and in 1 instance it reached 48,000. An anemia with falling red blood count and hemoglobin level usually necessitated frequent blood transfusions. In those infections arising in the perineum, dysuria and even retention were prominent symptoms.

The clinical course was characterized by the rapidity of extension of the process, almost one-half of the wall of the torso being involved within 4 to 5 days in some instances. Death occurred in 1 case on the 11th day of illness when treatment failed to check the disease.

Early diagnosis, essential for most effective treatment was based on the history and clinical findings. The prognosis was excellent in the patients treated promptly and adequately. Since delay in diagnosis permitted further spread of the infection and increased the duration of morbidity early investigation of wounds in questionable cases is obvious. Roentgenograms for soft tissue detail have aided somewhat in the recognition of gas and in determining the limits of spread in areas not accessible to digital examination.

The principle method of treatment for this condition was early and adequate surgery consisting of radical decompression of the involved area by long and wide incisions through the skin and subcutaneous tissues down to the superficial layer of the deep fascia and peripherally into healthy tissue beyond the further most limits of the lesion. In some instances, it was possible to drain the area effectively by a single linear incision with undermining of the skin flaps. Since radical incisions arrested the process, amputation was usually necessary and the one in Case 7 was done on the basis of a mistaken diagnosis of gas gangrene.

Chemotherapy was used only as an adjunct to surgery. Because of the mixed bacterial flora parenterally administered penicillin in doses of 50,000 or more units every 2 or 3 hours is recommended along with sulfadiazine or streptomycin in therapeutic amounts.

Daily dressings of the wounds with zinc peroxide ointment appeared to aid in the control of the infection which usually was so extensive that fever, elevation of pulse rate and signs of toxemia persisted for 3 or more days postoperatively. After control of the infection and development of clean granulation tissue skin grafting was done.

Important general supportive therapy included intravenous fluids for adequate hydration and electrolyte intake repeated whole blood transfusions, and rest.

#### SUMMARY

The causes of cutaneous crepitation have been reviewed and the two principal types of acute crepitant cellulitis caused by bacteria have been described. Although clostridial or anaerobic cellulitis has been well established, the non-clostridial type has been seldom reported. Twelve cases of non-clostridial crepitant cellulitis have been reported and their clinical features have been analyzed.

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# A DISCUSSION OF THE USES OF METALS IN SURGERY AND AN EXPERIMENTAL STUDY OF THE USE OF ZIRCONIUM

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As modern surgery has developed repeated efforts have been made to fashion metal appliances to serve in the internal fixation of fractures, in restoring the continuity of vessels, and in the support of soft tissues, as well as for many other uses.

Venable and Stuck (27) in their review of the general considerations of metals for buried appliances in surgery, stated that Petronius in 1565 devised a gold plate for the repair of defects of the cleft palate and that Lapeyrolle and Siere in 1775 were the first to place metal wire about a fracture.

Since then metals in the form of wire, plates, pins, screws, buttons, and tubes have been used by many surgeons. Beginning in 1905 the work of Sir Arbuthnot Lane stimulated a great interest in the use of buried metal appliances in fractures. He advocated the use of steel and was supported by Sherman in this country who recommended the use of vanadium steel for plates and screws.

Many studies have been made of the toxicity of metals in tissue cultures, the corrosion and weight loss of buried metal appliances in the body, and the histological changes in tissues adjacent to metals.

It had been apparent to Von Bruever in 1908 that the metallic particles set free by corrosion could be identified in the surrounding tissues. He also noted that where two different metals, copper and zinc, were implanted close together rhythmic contractions occurred in the underlying muscles, and the connective tissue cells were arranged in the direction of the electric current.

Zur H in 1924 studied the reactions of bone to a vanadium metal and stated that in many

a metal could modify other elements only at the expense of its own substance and that in an electrolyte this was accomplished by the dissolution of metallic ions to the end that a colloidal solution was formed which conformed to the solution pressure of the metal. He believed that this process underlay the phenomenon which is termed corrosion, and that this explained the change which occurs in ordinary steel and iron when they are exposed to the action of an electrolyte, such as tissue fluid. Other observers, Orsos in 1925, Macmonteil in 1935, and Percy and Damany in 1938 also stated that the electrolytic phenomenon was the important factor in causing the unfavorable reaction of bone to the metals used for ortho-synthesis.

Venable and Stuck (25) and Venable, Stuck, and Beach (3) deserve great credit for calling the attention of American surgeons to some of the fundamental principles involved in the evaluation of corrosion and tissue reaction. They stated that corrosion is the disintegration of a metal in its fluid environment and is due to electrolysis. In 1936 they performed a number of animal and chemical experiments from which they concluded (7) that all the metal commonly used in surgery were subject to electrolytic activity in body fluid, and that the extent of tissue damage was roughly equivalent to the amount of galvanic action which took place between the metal.

The theory that the electrolytic action of metals in tissue fluid is the important factor is not held by all observers. Moncreaux, Meyer, and Chélette in 1910 studied the ionization of metals on the growth of fibroblasts, and their cells in tissue cultures. They expressed the opinion that two metals of different potential in a solution did not have an action, except in so far as the rate of ionization and that the importance of the electrolytic phenomenon



created by the association of two metals was negligible as compared with the toxicity of the metal itself.

In 1940 and in 1942 Bothe Beaton and Davenport (3) and Bothe and Davenport (2) reported experimental work which led them to believe that bone reactions were not closely correlated with the magnitude of potential differences but remained characteristic for a given metal or alloy. They stated that electrolysis was not the primary cause of unfavorable bone reactions but that these are determined by the physical and chemical properties of the metal itself. The solubility and the degree of toxicity of the dissolution products appeared to them to be the chief factors in unfavorable reactions.

From this review it is apparent that the fundamental principles involved in the reaction of metals to human tissues are not agreed upon by all investigators. Any metal which is contemplated for use in tissues on a permanent or semipermanent basis should be chemically and physically inert and cause no electrolytic phenomena. Having fulfilled these criteria the metal may be tried in experimental animals to observe tissue reaction and toxic effects and then used clinically in any way that the metal can be mechanically fashioned.

With regard to this latter point Venable (23) has stressed the fact that there is much more to the detail of the requirements of physical fitness than shape and size so that all metals must conform to necessary specifications as to strength, durability, malleability, fragility, torsion and resistance to fatigue as well as resistance to corrosion. Also there are certain metals which have inherent properties best suited for suture material and others for plates and screws and still others for tubes.

Since 1920 surgeons have endeavored to find a suitable 'alloy' which will have no deleterious effects in the body. Due to the variation in the manufacture of alloys, one of the most intricate of technical specialties, it was impossible to standardize the physical and chemical properties adequately for uniform clinical results. In the past decade three alloys, vitallium, ticonium, and 18-8-SMO stainless steel have been developed which are passive enough for use in the human body.

Vitallium is an alloy of cobalt, chromium and molybdenum. The material is cast and is very hard. It has been used for bone plates (5, 6, 29), cranioplasty (9, 19), reconstructive orthopedic appliances (16, 26) and common duct reconstructions. The faults of vitallium are its inability to be worked cold or to be drawn into wire and the fact that casting is necessary.

Ticonium is an alloy of nickel, cobalt, chromium and molybdenum. It has been investigated by Campbell, Meirowitz and Tompkins (4) who found it to be strong rather light, and also malleable. In a study in which ticonium and vitallium were used for cranioplasty in dogs they found that cast ticonium, to which a small amount of beryllium had been added for casting purposes, was cytotoxic. However the wrought ticonium without beryllium showed the same inertness as vitallium. We have been unable to find reports of the clinical use of ticonium.

18-8-SMO stainless steel contains roughly 18 per cent nickel, 8 per cent chromium, 2 to 3 per cent molybdenum and the remainder iron, manganese and carbon. This steel can be machined and it has a high tensile strength. The disadvantage of using it in the body is that there is thought by some to be a slow steady galvanic action which over a long period of time produces irritation (27). This has been disputed by some surgeons who have used this steel for cranioplasty plates and screws, as well as wire. However sufficient time has not elapsed for an adequate evaluation of its clinical application.

The fourth metal that has been reported as being useful for surgical application is a basic element, tantalum (8, 20, 22). It is a metal which is extracted with difficulty from deposits which are sparsely distributed over the earth's surface. It is strong, tough, and malleable and can be drawn into wire or machined. It is inert in tissues and has been used in the form of plates for cranioplasty, screws, foil and wire with considerable success. The disadvantages of tantalum are that it cannot be cast and is extracted with difficulty from raw material that is rare. It is expensive.

The purpose of this investigation is to present a preliminary evaluation of zirconium

another element for use in surgery. There are no reports in the literature that we have been able to find of the use of this metal in experimental animals or human beings. The following presentation will be used: (1) zirconium, its physical and chemical properties; (2) the electrolytic properties of zirconium; (3) the reaction of rectus fascia and muscle to zirconium wire; (4) the reaction of bone to zirconium screws and intramedullary pins; (5) the repair of cranial defects of dogs with zirconium plates; (6) the reaction of brain to zirconium foil; (7) the reaction of brain to silver tantalum and zirconium hemostatic clips.<sup>1</sup>

### ZIRCONIUM, ITS PHYSICAL AND CHEMICAL PROPERTIES

Although zirconium (1, 7) is eleventh in the table of abundance of elements in the earth's crust, it has been available to man in a useful form only in the last few years. In 1925 a method of making ductile zirconium was developed and since then rapid advances have been made in the use of zirconium in industry, particularly in the electronic industry. The extraction and separation of zirconium from its raw state as the silicate and the oxide is still difficult.

Some of the physical properties of zirconium are compared with those of tantalum and 18-8-SMO stainless steel in Table I. The significance of these facts will be discussed at the end of the paper.

Although at high temperatures zirconium is extremely active, it is rather surprising that below 200 degrees C. zirconium is almost inert.

Items 5, 6, and 7 will be considered in succeeding papers.

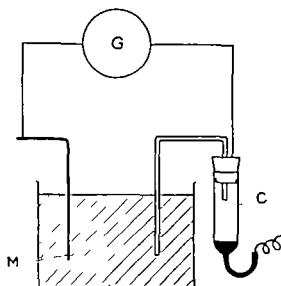


Fig. 1. Diagram of the circuit used for the electrolytic studies. G, Sensitive galvanometer; C, calomel half cell; Pss, physiological saline solution; M, metallic strip. The final steady readings after polarization had occurred were: aluminum 200, copper 50, silver 7, tantalum, 0 to 0.5 and zirconium 0 to 0.5 microamperes.

and corrosion resistant. Fully annealed zirconium is soft and malleable and can be drawn and shaped easily. It work hardens to a considerable degree but also has a high work capacity. Approximately 15 minutes at 750 to 800 degrees C. will fully anneal zirconium.

Chemically one of the most important properties of ductile zirconium is its corrosion resistance. The alkali resistance of zirconium is greater than that of tantalum. The two metals show the same resistance to hot concentrated hydrochloric acid. Zirconium is corroded much less than 18/8 stainless steel by hot 75 per cent phosphoric acid.

TABLE I.—FUNDAMENTAL FACTS CONCERNING ZIRCONIUM, TANTALUM AND 18-8-SMO STAINLESS STEEL

Metal	Yield strength in psi		Tensile strength in psi		Ductility per cent		Specific gravity	Modulus of elasticity in psi
	Annealed	Unannealed	Annealed	Unannealed	Annealed	Unannealed		
Zirconium	30,000	35,000 to 80,000	45,000 to 60,000	60,000 to 90,000	30 to 40	to 5	6.54	1,000,000
Tantalum	5,000 to 30,000	30,000 to 70,000	5,000 to 60,000	30,000 to 90,000	20 to 40	1	6.61	7,000,000
18-8-SMO stainless steel	30,000 to 90,000	Not used in this form	90,000 to 95,000	Not used in this form	35 to 60		7.86	30,000,000

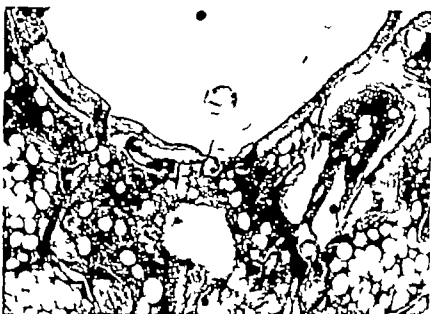


Fig. 2. a, Cross section of tibia, 84 days,  $\times 8$ . The hole in the center is the former site of the intramedullary zirconium pin. The thin fibrous capsule around the pin and the relative absence of reaction are demonstrated. b, Section outlined in a,  $\times 75$ . This shows the nature of the thin ring of chronic inflammatory tissue and the fibrous capsule which formed around the zirconium pin.

#### THE ELECTROLYTIC PROPERTIES OF ZIRCONIUM

The importance of the electrolytic action of metals in relation to tissue reaction has been discussed. Venable and Stuck (25) concluded

that the current flow registered by a microammeter with vitallium and stainless steel in physiological saline solution was a good index of how much tissue reaction might be expected



The fascia at the lateral side of the patella was incised and the patella dislocated medially. A hole was drilled from the articular surface of the tibia vertically into the medulla of the tibia, and a zirconium pin 2.0 centimeters in length by 3.0 millimeters in diameter was inserted. The patella was then replaced and the joint capsule closed with interrupted black silk sutures. On the medial aspect of the tibia below the knee joint a hole was drilled through the cortex into the medulla and into the cortex of the opposite side. A zirconium screw 1.6 centimeters by 3.5 millimeters was then inserted. The skin was closed with a continuous subcuticular black silk suture. The dogs were sacrificed after 6 and 12 week periods. The screws and pins were removed after decalcification with formic acid and sodium citrate. The bones were imbedded in paraffin and the sections were stained with hematoxylin and eosin.

**Results.** Grossly there was no necrosis softening infection or discoloration evident in any instance. The screws and pins did not become loose and there was no evidence of gross osteolytic action. The heads of the screws were covered with a capsule continuous with the periosteum of the bone. The articular cartilage had regenerated over the end of the pin in every case and the point of entrance of the pin could no longer be seen.

Microscopically the intramedullary pins provoked only minimal foreign body reaction. The bony trabeculae were compressed around the pin and at the 12 week period there was a delicate fibrous connective tissue capsule in a few cases (Fig. 2). The sections of cortex showed proliferation of the periosteum around the head of the screw which was denser and thicker at the 12 week period. In some sections there were small areas of chronic inflammatory tissue which were limited to the immediate vicinity of the screw.

#### DISCUSSION

After evaluating the physical chemical and electrolytic properties of zirconium as well as the experimental evidence of the minimal reaction of fascia muscle and bone to zirconium we believe that this metal has a place in surgery.

Zirconium is abundant in the raw state. The cost of zirconium has not as yet been stabilized. However it is anticipated that it will be considerably less than tantalum although not as cheap as stainless steel. Furthermore the manufacturers anticipate that increased industrial demand will permit cheaper production as well as improvement in the method of making ductile zirconium. The fact that zirconium is an extremely plentiful metal whereas tantalum is rare in the raw state may play a significant rôle in the development of zirconium. Chemically zirconium is extremely inert.

Zirconium is an element which seems to be free of the variations in electrolytic activity found in some metals used in surgery. This electrolytic passivity has been confirmed by the experimental work in physiological saline and bone reported above. However, whether or not electrolysis is the fundamental factor in the tissue reaction produced by metals cannot be deduced from these results. A detailed study of the electrolytic properties of all metals used in surgery should be done in the near future through the close co-operation of a physicist and a research surgeon. There is no doubt that in the future new metals will be tried experimentally and clinically and it will be necessary that these fundamental principles be known.

The importance of avoiding the use of different metals in the same operation has been stressed by Venable (23). If a vitallium plate is fixed with steel screws, there will be an intense reaction. Key recently reported 3 cases of fractured femurs in which Neuman stainless steel pins were fixed with screws of different types of stainless steel causing an intense reaction necessitating removal of the pins. There is a tendency in most operating rooms for metal appliances to accumulate. Many of the metals particularly the screws have a similar appearance and for this reason there should be a uniform method of marking each metal even each small screw so that the surgeon who is directly responsible for success or failure of the operation may have uniform composition of materials.

It should be emphasized that both tantalum and zirconium are pure elements and as such

may have properties superior to the surgical alloys. In industry (12) it has been found that alloys are subject to a phenomenon known as stress corrosion. In other words even though initially an alloy may be corrosion resistant over a long period of time with repeated stresses and strains the individual elements composing the alloy may be changed in their relative physical relationships. This change is sufficient to allow corrosion. It is probably also true that alloys such as vitalium titanium and 18-8-SMO stainless steel which are used as supporting bone plates being subjected to multiple stresses and strains over 30 to 40 years may ultimately change from inert metals to active and dangerous metals. This "stress corrosion theory has been demonstrated by metallurgists for industrial alloys but has not been confirmed as yet for surgical appliances.

The physical properties of zirconium are such that in the cold state it can be drawn into rods, ribbon, and wire of varying degrees of malleability. It can be rolled into plates and machined into screws adaptable for neurosurgical or orthopedic purposes. Foil has been rolled to 0.001 inch and with further refinement of technique thinner foil may be obtained. Tubes of various degrees of malleability have been made for biliary, vascular and urological surgery.

It is not the purpose of this paper to discuss the relative merits of tantalum, stainless steel and zirconium for suture materials, bone plates, and intramedullary pins but the facts recorded in Table I are fundamental for the proper evaluation of the part zirconium will play in surgery. A few simple definitions of the terms used will help to clarify the table.

Annealing is a method of removing work stresses and altering crystal size. Tensile strength is the stress required to produce a permanent break of the metal. Yield strength is the stress required to produce a permanent deformation that is to say, metals act like an elastic band for which there is a point when the material will be overstretched and will not spring back to its original length. Modulus of elasticity is the stress required to produce a unit deformation. These 3 factors are expressed in pounds per square inch (psi).

Ductility or the ability to bend the metal is expressed as the percentage elongation.

The specific gravity of tantalum is more than twice that of zirconium and stainless steel whereas the modulus of elasticity of zirconium is about half that of tantalum and stainless steel. In other words it takes half as much energy to move a unit of zirconium as it does to move a unit of tantalum. Because of this a 0.015 inch zirconium plate is easier to bend than a plate of tantalum of similar thickness. Consequently it might be necessary to use a thicker plate of zirconium which however, would still weigh less than the tantalum plate. (Specific gravity of tantalum is two and a half times greater than zirconium.)

For purposes of suture material the tensile strength is an important factor. Stainless steel with a value of 90,000 psi is superior to the annealed varieties of tantalum and zirconium which are approximately 50,000 psi. Unannealed tantalum and zirconium may have tensile strengths as high as 130,000 psi but the ductility is decreased from about 30 per cent to 2 per cent. This means that the unannealed varieties of zirconium and tantalum are probably too brittle for suture material. Actually the problem is not as simple as this and includes the evaluation of the roughness of the surface to prevent slipping and springiness of the knot with double and triple throws which might cause unwinding. A fine braided zirconium wire is being developed which may prove to be very useful.

The surgeon must decide by careful experimental and clinical methods the relative inertness in tissues and adaptability of the metals for his particular needs.

Experimentally in dogs zirconium appears to be tolerated well. In this study we have shown that zirconium wire causes a minimal reaction comparable to steel and tantalum wires when placed in the rectus muscle and fascia of dogs.

The gross and microscopic reaction of bone to zirconium has been demonstrated to be minimal at 6 to 12 week periods in the tibiae of dogs. It is well known that reaction to bone is extremely hard to evaluate and a long period of time is important before categorical statements should be made.

In a later paper on hemostatic clips a more delicate method for the evaluation of tissue reactivity will be discussed. Strips of silver tantalum and zirconium were placed in the brain of dogs and the results, confirming the work of Pudenz showed that silver causes a severe reaction whereas tantalum is almost completely inert. Zirconium was not quite as inert as tantalum but certainly caused less reaction than silver.

The introduction of a new metal into surgery is a gradual process requiring careful experimental and clinical observations. We believe that zirconium causes as little reaction as several metals that are used at present in surgery and also has physical properties which will be adaptable to certain surgical appliances and material.

#### SUMMARY AND CONCLUSIONS

1 The use of metals in surgery and the principles of the reaction of tissues to metals have been discussed. Four metals, vitallium, titanium, 18-8-SMO stainless steel and tantalum have proved to be sufficiently passive for use in the human body.

2 A new metal zirconium has been studied experimentally. Zirconium is an element which has similar physical properties to tantalum but it is two and a half times lighter than tantalum. They are both electrolytically inert. The tissue reaction caused by zirconium sutures placed in the rectus fascia of dogs, was minimal. Intramedullary zirconium pins and bone screws provoked only very slight reaction at 12 weeks.

3 Zirconium which has proved to be a lighter more malleable and cheaper metal

than tantalum warrants further study regarding its use in surgery.

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# REACTIONS TO MORPHINE IN AMBULATORY AND BED PATIENTS

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IT has been reported that the incidence of vomiting following the administration of therapeutic amounts of morphine is very low. For example vomiting followed the use of morphine in only 2.3 per cent of 776 patients at the Massachusetts General Hospital (6). On the other hand an examination of certain physiological studies of morphine reveals a very high incidence of vomiting 57 per cent (5) and 93 per cent (2) following the administration of 16 milligrams and 100 per cent (9) after the injection of 30 milligrams of morphine. Since it is unlikely that groups of individuals vary so widely in their response to a drug it seems probable that different experimental conditions might be responsible for the differences. Analysis of the groups with low and with high incidences of vomiting revealed one point of importance the former group represented postoperative cases confined to bed while the latter was composed of normal ambulatory subjects. Batterman has reported that side reactions occur in 70 per cent of ambulatory patients given demerol but in only 27 per cent of bed patients. Similar studies following the use of morphine have not been reported with the exception of one study dealing with 5 subjects given morphine (8) in whom nausea usually followed attempts to get up and was relieved by recumbency. In order to test whether a change to the ambulatory state was responsible for the marked increase in vomiting following the administration of morphine we subjected large numbers of normal individuals and patients to the drug. This study confirmed the suspicion that vomiting produced by morphine is much more frequent in the ambulatory condition. In addition, information has been gathered bearing upon (a) other side effects of morphine, (b) their length of action (c) possible counteraction of side

effects by food, pain, atropine or amphetamine or avoidance by the substitution of demerol.

## METHODS

Studies were done upon 211 normal ambulatory individuals and 200 patients confined to bed (ages 19 to 61). No subject knew whether a drug or a placebo was administered and the great majority did not know that the studies involved the use of morphine. Morphine was administered orally, subcutaneously or intravenously in dosage ranging from 8 to 30 milligrams. In 16 cases atropine (0.6 mgm) and in an additional 23 subjects amphetamine (20 mgm) was given along with the morphine. A complete report of all symptoms and their time of occurrence (covering a 24 hour period) was written by each of the medical student subjects (172) in the case of hospital patients (239) symptoms were recorded at intervals by one of us with the assistance of Dr. James Hardy. The subjects were usually ambulatory immediately after the injection except that some in whom the respiratory and circulatory effects of morphine were studied (34) did not become ambulatory until 1 to 2 hours after injection.

## RESULTS

*Character of symptoms.* The main symptoms experienced following the administration of morphine were (in approximate order of frequency) dizziness, nausea, itching (especially of nose), feeling of warmth (particularly in the face), sensations of weakness, heaviness of limbs and head, fatigue or depression, visual blurring, euphoria, headache, miscellaneous gastrointestinal symptoms (such as epigastric fullness, increased peristalsis, belching or abdominal pain), vomiting, dryness of mouth, difficulty in urination, tremor, fatigue of tonic neck muscles and hiccough. In addition those receiving morphine intravenously often noted temporary paresthesias, palpitation and

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TABLE I — FREQUENCY OF SYMPTOMS IN AMBULATORY SUBJECTS AFTER THE ADMINISTRATION OF PLACEDOS OR MORPHINE.

	Placido	Subcutaneous morphine			Intravenous morphine	Oral morphine	
Dosage (mgm.)		3	5	20	5	5	30
No. of subjects	25	5				64	
No. symptoms	83%	97%				17%	14%
Nausea		20	100%	100%	85%		36
Vomiting		9	5	30	44	3	14
Diarrhea		26	21	100	75	8	
Warmth		3	57	60	71		4
Itching		26	20	70	5		7
Sleepiness, fatigue or mental depression		5	70	60	70		
Euphoria		17	3	40	60		
Visual blurring		9	5	50	25		7
Minor gastrointestinal complaints		18	1	40	7	5	18
Headache				40	40		20
Dryness of mouth		17	3	30	7	1	

lessening of respiratory effort immediately after the injection.

**Frequency of symptoms** Table I shows the frequency of symptoms following administration of various dosages of morphine subcutaneously intravenously and orally. It may be noted in Table I (all data obtained from normal medical students) that a 2 to 4 times as much morphine had to be administered orally to produce an incidence of symptoms similar to that following parenteral administration. Because of this low incidence of side effects one might favor use of morphine by the oral route. We are inclined to believe however that these minimal side actions are associated with decreased analgesia and are the result of incomplete absorption. This remains to be proved experimentally.

We have found no evidence that the use of the intravenous route reduces the incidence of nausea and vomiting as noted by Pearman.

**Length of action of morphine** In Table II are shown the time for onset of nausea and vomiting and the persistence of nausea following the administration of morphine alone and in combination. It should be emphasized that though nausea following morphine usually occurred within 2 hours, in some cases it was de-

layed 3 to 6 hours. More important was the finding that when vomiting occurred this was usually delayed 3 to 5 hours but occasionally did not develop until 7 to 8 hours. It is usually considered that the effects of morphine wear off in 4 to 5 hours (9) while this may be true of the analgesic action it does not hold for the gastrointestinal effects.

**Modification of symptoms produced by morphine** 1. *By bed rest* Two hundred patients were given 15 milligrams of morphine subcutaneously as part or all of preoperative medication. These patients were questioned by the anesthetist just before operation concerning the development of nausea or vomiting. Only 14 (7 per cent) reported nausea; this was annoying in only 2 (1 per cent) and in these retching occurred. These figures should not be compared with those in Table I since the preoperative cases were followed for only 15 minutes to 3 hours. However 68 of the 200 were followed for more than 1 hour and of this group the incidence of nausea was 12 per cent in 19 studied for more than 2 hours, the incidence of nausea was 12 per cent. In 25 normal ambulatory subjects given 15 milligrams of morphine 50 per cent of those ultimately developing nausea noted it within the first hour and 90 per cent within the first 2 hours.

More conclusive evidence of the importance of position in the production of nausea and vomiting is the following: 19 normal subjects were given 15 milligrams of morphine intravenously or subcutaneously in the supine position. Twelve subjects lay down for 1 to 2 hours after injection; during this time only 1 subject developed nausea. Immediately after arising 3 developed nausea and within another hour 5 more became nauseated. The 7 other subjects lay in bed all day; none developed nausea.

In practically every instance nausea caused by morphine could be relieved by the subject's lying down. It often recurred shortly after arising. In 2 cases nausea was brought on merely by rolling the subject from his back to one side and in one subject by lateral rotation of the head.

2. *By food in stomach* In some subjects, nausea occurred shortly after the ingestion of food. One group of subjects ingested 15 milli-

TABLE II—TIME IN HOURS FOR ONSET AND OF DURATION OF NAUSEA AND VOMITING FOLLOWING SINGLE DOSES OF MORPHINE

Drug and dose—mgm.	Nausea						Vomiting	
	Route	Onset		Duration			Onset	
		Range	Average	Range	Average		Range	Average
5 morphine	S.C.	3-3	7		7		-6	3.2
50 morphine	S.C.	5-4	8		7		5-7	5.5
5 morphine	LV	0-4.5		5-35	3		2-8	6
5 morphine 6 tropicac	S.C.	8-6	5				5-6.5	5.5
5 morphine 50 amphetamine	S.C.	0.5-6	2.7	2-3	4.6		1-7	2.6

grams of morphine 3 hours after the last meal the total incidence of gastrointestinal complaints was 13 per cent. A similar group in gested the same amount immediately after lunch 35 per cent reported symptoms referable to the gastrointestinal tract.

3 *By atropine* The incidence of nausea and vomiting was not reduced by atropine. When 0.6 milligram of atropine was given simultaneously with 15 milligrams of morphine (subcutaneously) 69 per cent of the ambulatory subjects became nauseated and 24 per cent vomited. No marked differences occurred in the incidence of other symptoms (as compared with morphine alone) except for a greater occurrence of visual complaints and dryness of the mouth when atropine was added.

4 *By amphetamine* The incidence of nausea and vomiting was not reduced by the addition of 20 milligrams of amphetamine subcutaneously though the onset may have been delayed. The average time of onset of nausea in this group was 160 minutes as compared with 100 minutes in the group receiving morphine alone (Table II). Because of difficulties in controlling the extent of ambulation in different groups this difference cannot be considered to be significant. However we have observed that severe nausea following morphine alone was relieved completely by an injection of amphetamine the effect was temporary and nausea recurred in severe form in 1½ hours.

5 *By pain* In 10 subjects severe pain (bends) was produced by exposing them to equivalent altitudes of 38,000 feet in a low

pressure chamber. Following injection of 10 milligrams of morphine nausea occurred in 60 per cent despite the presence of intense pain.

6 *By substitution of demerol* An experiment similar to that recorded under paragraph 5 was carried out, substituting 100 milligrams of demerol for morphine. Six of the 10 subjects participated in both experiments. Following the administration of demerol nausea occurred in 50 per cent, severe dizziness occurred in 80 per cent, drowsiness in 60 per cent, tremor in 40 per cent, and dryness of the mouth in 40 per cent. In experiments upon pain free normal subjects on a tilt table we have noted that severe nausea usually follows tilting into the feet down position if demerol had been administered. The occurrence of marked symptoms following the use of demerol in ambulatory patients has been noted previously (1).

#### DISCUSSION

It is becoming evident that clinical studies of a drug new or old must not be confined to resting subjects or patients. A previous study of the action of morphine in patients tilted upright revealed an important action upon the circulation that had not been noted in supine subjects (3). The present study reveals the frequent occurrence of symptoms in the ambulatory state that occur rarely in bed patients.

These results suggest that morphine should not be given without warning to ambulatory patients or to patients who may become ambulatory shortly after the injection. They also

indicate that when morphine must be given to patients in whom vomiting might be highly undesirable or even disastrous, emesis may be prevented by (a) insistence upon the supine position (b) administration of the smallest and least frequent dosage possible, and (c) restriction of food intake. There appears to be little reason to combine either atropine or amphetamine with morphine in an attempt to reduce the incidence of nausea or vomiting.

The cause of the more frequent nausea and vomiting in the ambulatory state remains to be determined. It does not appear to be related to the circulatory action of the drug (3). It may be related to reflexes set up in the vestibular apparatus due to change in position; this appears to be the cause of the nausea induced by lateral rotation of the body or head in bed patients. Other reflexes such as traction reflexes set up by the pull of the abdominal organs in the erect position cannot be excluded in the other subjects; however, there is no reason to believe that these would produce the dizziness and light-headedness that occurred in the ambulatory state.

Postoperative nausea or vomiting is often attributed to factors other than morphine because of the long interval between the nausea and the injection of morphine. These studies show that nausea and especially vomiting may

often be delayed 6 to 8 hours after a single administration and may last an additional 4 to 5 hours.

#### SUMMARY AND CONCLUSIONS

- 1 Nausea and vomiting occur rarely following the use of morphine in bed patients, but very frequently in ambulatory patients.
- 2 Nausea and vomiting can be prevented as a rule by using small doses of morphine, or by insisting upon bed rest.
- 3 The frequency of occurrence of these symptoms is not lessened by administration of atropine or amphetamine.
- 4 Other symptoms that follow the administration of morphine are discussed in relation to dosage and mode of administration.

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# RE-EVALUATION OF THE ROLE OF THE PYLORIC ANTRUM IN MARGINAL PEPTIC ULCERS

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SINCE Wolfer first devised a gastroenterostomy anastomotic or marginal peptic ulcers have continuously confronted the surgeon. The increasing though still incomplete knowledge of the phases of gastric secretion has markedly influenced the trends in the surgical treatment of peptic ulcers. The effect of the pyloric antrum on the gastric phase of digestion has been a subject of much discussion. The influence of the antral mucosa on the incidence of marginal peptic ulcers has also been debated. The following presentation will be concerned with the rôle of the pyloric antrum in marginal jejunal ulcers experimentally in the dog.

The researches of Pavlov established the cephalic gastric, and intestinal phases of gastric secretion. A fourth continuous phase of gastric secretion has been recently emphasized by Sandweiss. Fundamental contributions to this general subject have been made by Beaumont, Cannon, Carlson (14, 15), Alvarez, Babkin (8), Ivy (37), Wolf and Wolff and a host of other investigators. Their works may be referred to for reviews of the broader aspects of this presentation. Concomitantly the development of gastric surgery was affected by the research of the above investigators. Marginal jejunal ulceration following gastrointestinal anastomoses has been the stimulus of much surgical research.

The first marginal ulcer in man was reported by Braun in 1899. Watts in 1903 described the first marginal ulcer occurring spontaneously in the dog. Following Bayliss and Starling's discovery of secretin, Edkins (20, 21) described a substance that he had isolated from the pyloric mucosa of cats and dogs. This substance he designated gastrin. After extraction and intravenous injection it

was capable of stimulating the acid secretion of the fundic glands of the stomach. In the succeeding years there was considerable debate concerning the actuality of gastrin. Lum in 1922 found that pyloric extracts caused gastric secretion. Extracts of the cardia and duodenum were less active. He felt that differences of opinion were due to different methods. Ivy (35, 36) using a completely denervated subcutaneously transplanted gastric pouch conclusively demonstrated the origin of a humoral factor from the pyloric region capable of stimulating gastric secretion. He suspected that this substance was histamine. Komarov (43) in 1938 reported a protein like substance having a specific secretagogue effect on the fundic glands of the stomach. It could be extracted in a histamine free form from the pyloric mucosa and to a lesser extent from the duodenal mucosa of dogs and hogs. In 1942 Komarov (44, 45) reinvestigated the problem of gastrin. He was unable to isolate the substance in a crystalline form and was unable to understand completely its mode of origin and transportation. Thus it was impossible definitely to establish gastrin as a true hormone. He felt that the crudeness of the extracts of many previous investigators had led to much of the confusion of the knowledge concerning gastrin. Friedman has recently noted a specific secretagogue in the pyloric mucosa of the dog. This subject has been very completely reviewed by Ivy (38), Schriffin (68), Komarov (45), Uvnas, Babkin (5, 7, 8) and Ihre in recent literature.

In conjunction with the attempts to prove or disprove the presence of a specific hormone by direct extraction from the pyloric mucosa, many investigators used an indirect approach in an attempt to assay the effect of the pylorus on gastric secretion. The relationship of the pylorus to marginal jejunal ulcer was suspected first by von Eiselsberg (81). The effect of various operative procedures on gastric

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secretion and postoperative complications has been most recently reviewed in a paper by Wangensteen (83) and his associates. Pavlov, Lonnquist, Gross, Krzyshkowski, Sawitsch and Zeljony, and Grindley noted that introduction of food and secretagogues into isolated pouches of the pyloric antrum caused increased gastric secretion. Using Pavlov or Heidenhain gastric pouches, Smidt, Portis and Portis, Steinberg (73), Shapiro and Berg, and Klein noted a decrease in secretion in the pouches after resection of the pylorus. Thompson reported a decrease in acidity of the stomach that was roughly proportional to the amount of the pylorus removed. Lewis observed a decrease in gastric secretion after resection of the pyloric mucosa with maintenance of the normal gastroduodenal muscular continuity. Wilhelmj and his associates (33, 86-89) in a series of papers on the general subject found a decrease in the total volume of gastric secretion in whole stomach pouches after pyloric resection. Wangensteen (83) using histamine as an exciting agent found no change in the secretory response after removal of the pylorus. Grindley reported little change in the total volume of secretion in a Pavlov pouch after resection of the pyloric antrum. Priestley and Mann felt that the pylorus exerted little effect. Masaki observed a marked increase in the secretion of a previously prepared Pavlov pouch with frequent gastrojejunal ulcers after exclusion of the pylorus in rabbits and a simple gastroenterostomy. This did not occur after excision of the pyloric segment. Uvnas believed that the cephalic phase of gastric secretion was controlled by a combined neurohumoral mechanism identical in principle with that of the gastric phase. The pylorus was considered an integral part of this mechanism. Evidence for this were the following observations. Gastric secretion during vagal stimulation ceases, or is diminished if the blood supply of the pylorus is interfered with or the pyloric mucosa is anesthetized or resected. During vagal stimulation a secretagogue is liberated from the pyloric region. These secretagogues may be extracted after the method of Komarov and when injected intravenously cause only slight secretion. However when injected during vagal stimu-

lation an abundant secretion occurs. This extract was not histamine. Babkin and Schacter (6, 7) questioned and later denied the above conclusions basing their statements on the fact that in Uvnas' acute experiments, depression of gastric secretion was due to operative shock, and not due to resection of the pylorus. They found no evidence that close co-operation between vagi and pylorus was necessary for production of gastric juice. The two mechanisms could work separately. Wilhelmj (88) believed that an intrinsic pylorofundic reflex did not exist. In summary the general consensus is that a gastric humoral factor exists that is capable of stimulating gastric secretion after absorption into the blood stream. Its exact nature is unknown. The pylorus is important in the origin of this humoral factor. It is similar to but does not seem to be histamine.

During the past six decades the scope of gastric surgery has been affected by two other factors in addition to the increasing knowledge of the physiology of the gastric secretion. The first is improved technique. The second is the increasing awareness of the relative effects of the complications compared with the total accrued benefits of gastric surgery in the ulcer patient. Excluding immediate postoperative complications such as a duodenal fistula, most of the late complications may be grouped under two heads. Mechanical difficulty and failure sufficiently to reduce gastric acidity. The former may be almost completely eliminated by proper technique. The latter factor has long been recognized as of first importance and has recently been reviewed by Wangensteen (83, 84, 32) and his colleagues. Yet the relation of acid and pepsin and its total combined effect is still unknown. The studies of Schifffrin (68) and Kolouch in this question are important. They noted that hydrochloric acid alone did not cause ulceration of isolated intestinal loops. However when combined with pepsin, ulceration always occurred. Nevertheless, peptic ulceration does not occur where there are low free acid values.

Following Edkins (20, 21) researches, pylorotomy was thought to be a satisfactory operation. Yet because of the incompleteness of resection of acid producing glands marginal

ulceration was common despite elimination of part of the gastric phase of digestion. Because of complications following incomplete closure of the duodenal stump in penetrating acute duodenal ulcers in proximity to the ampulla of Vater and common bile duct the pyloric exclusion operation was popularized by Finsterer though first described by Von Eiselsberg (80). There again resulted a higher incidence of marginal ulcers despite the fact that in many instances an adequate resection of the fundic glands had been carried out. Haberer (30, 31), Ogilvie, Druner, Fromme, Fuchs and Schur noted a higher incidence of marginal ulcers following the Finsterer type of exclusion operation. McKittrick, Allen (3), Lahey, Baker, Ogilvie and others have reported isolated and small groups of cases in which marginal jejunal ulcers have healed spontaneously after simple excision of the excluded pylorus. Moore and Allen (2) have described cases in which failures of vagotomy were due to the presence of the pyloric antrum. This may be an important observation in support of Babkin's (6) rebuttal of Uvnas' observations mentioned earlier. This has led many surgeons to consider excision of the pylorus and two-thirds to three quarters of the fundus as an essential in the satisfactory operation for the ulcer patient. Yet occasionally it is impossible to resect the pylorus as noted above. Druner describes the necessity for removing the mucosa of the excluded pylorus. Wangenstein (82) has reported a new technique for the excision of the mucosa of the pylorus that involves less blood loss. McKittrick has reported a two stage operation where the second stage is the excision of the pylorus after preliminary exclusion.

In the experimental study of the problems raised by the various types of gastric operations the experimental production of peptic ulcers in animals has been a necessity. This has been aided by two significant contributions. The first was the development of the Mann-Williamson (53) operation which short-circuits the alkaline secretions of the duodenum and exposes a loop of jejunum directly to the unneutralized acid secretion of the stomach. The second has been the introduction of intramuscular histamine beeswax preparations by Code and Varco. Further review of the

experimental methods of peptic ulcer production is beyond the scope of this paper. Reviews on this subject may be found in the papers of Lannin, Wangenstein (84), Morton, McCann and DeBakey.

Recently we have seen in this clinic 4 patients who had previously had gastric operations with pyloric exclusion followed by a marginal ulcer. In 2 of these mere excision of the pylorus without any operation of the ulcer resulted in prompt healing. This led us to review the subject and to do the following experiments.

#### EXPERIMENTAL METHOD

The influence of the pyloric antrum has been carefully assayed by the use of isolated pyloric and fundic pouches by numerous investigators referred to previously. Few investigators however have assayed the rôle of the pyloric antrum by the incidence of marginal ulceration in the experimental animal. Its importance has been deduced for the most part by the general incidence of marginal ulceration following various types of gastric operations and anastomoses.

Two groups of 10 dogs were selected. The animals were mongrels averaging 35 pounds in weight. Their hemoglobin, red blood cell count, white blood cell count, nonprotein nitrogen and plasma proteins were checked before use. Under intravenous nembutal anesthesia a subtotal gastrectomy was performed in each dog with removal of approximately two-thirds of the stomach. An anterior Polya type of gastrojejunostomy was performed utilizing the shortest possible afferent loop to the anastomosis by severing the ligament of Treitz and mobilizing the duodenum. The method used and position of the afferent limb of the anastomosis is shown in Figures 1 and 2. In the first group of animals the pyloric antrum was excluded after the method of Finsterer and left intact. In the second group of dogs the pylorus was resected (Fig. 3). Silk technique was used throughout and No. 0000 silk was used for the mucosal sutures. All operations were performed by one of us (J. A. S.) thus assuring constancy of technique. Following operation dogs were allowed water ad libitum the first day, milk the second and third days.

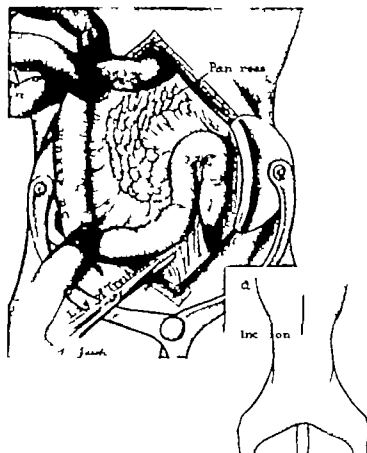


Fig. The duodenum, though not retroperitoneal, can be more completely mobilized by severing the layers of peritoneal reflection (ligament of Treitz), that extend into the right lower quadrant in the dog. A left paramedian incision as used.

milk and kennel diet combined the fourth and fifth days and a regular kennel diet supplemented with meat thereafter. This diet was kept constant throughout the entire length of the experiment. The animals were observed each day. Their behavior, appearance, appetite and stools were noted. Daily weights were measured at a constant time. After a suitable control period when the weights had stabilized and when the dogs were normal in behavior, intramuscular injections of histamine in beeswax were given. This material was prepared after the method of Code and Varco and of Hay. Though the technique is quite simple, two points of importance arose in attempts to secure a homogeneous mixture. The first was the necessity of grinding the crystalline histamine-diphosphate sufficiently

fine in a mortar. The second was the proper maintenance of temperature while mixing the materials. Heating a small mortar in water to boiling temperature and carefully drying with prompt use thereafter was sufficient to maintain the proper temperature. The mixtures were frequently assayed by noting the acid response in gastric analyses from the experimental animals.

Sixty-five milligrams of histamine diphosphate were injected intramuscularly each day except Sunday in the sacrospinalis or thigh muscles. The sites of injection were alternated. Care was taken not to place the material subcutaneously as hard indurated areas of foreign body and chronic inflammatory reaction resulted. Except for occasional vomiting at the time of injection, no untoward reactions

TABLE I—DOGS WITH PYLORIC ANTRA EXCLUDED

Number	Control eight pounds	Weight & death pounds	Days of histamine	Pathological findings
43-26	3	20½	76	Healed marginal ulcer after excision of pyloric antrum
46-40	28	35½	70	No evidence of ulcer
46-73	44	34	3	7-8 cm. chronic ulcer distal to anastomosis
45-38	43½	33	5	5-6 cm. chronic ulcer
44-200	44½	33	38	4-5 cm. chronic ulcer with central perforation
45-35	40	3	66	Healed marginal ulcer after excision of pyloric antrum
44-203	47	28	60	3-4 cm. chronic ulcer, N. change after excision of pylorus
45-47	42	20	3	Two ulcers. Largest 3-4 cm.
45-28	50	27	48	Induration and ulceration of entire marginal jejunum
46-48	43	26½	30	2-3 cm. chronic ulcer

resulted from these injections. When the animals showed symptoms of an ulcer namely listlessness anorexia vomiting tarry stools and weight loss roentgenograms were taken of the gastrointestinal tract utilizing tetraiodophthalimidoethanol as the contrast substance. Its use has been previously reported (39). Following this the dogs were explored. In 3 dogs of the first group the pyloric antrum was resected when a marginal ulcer was noted on exploration. The remaining dogs were sacrificed and a complete postmortem examination performed. Dogs of the second group where ulcers did not occur were explored at intervals. A gastrotomy was performed if any question of ulcer arose by gross palpation of the gastroenterostomy. After a 6 to 8 week period of injection if no ulcer developed final exploration was carried out the histamine was discontinued and the dogs were used for other sacrifice experiments. At this later date postmortem examinations were always performed for any evidence of an old healed ulcer. No regular gastric analyses were carried out except in isolated dogs to check their acid secretion or to assay histamine preparations.

#### EXPERIMENTAL RESULTS

In the first series of 10 dogs with the pyloric antra excluded 9 (90%) developed marginal

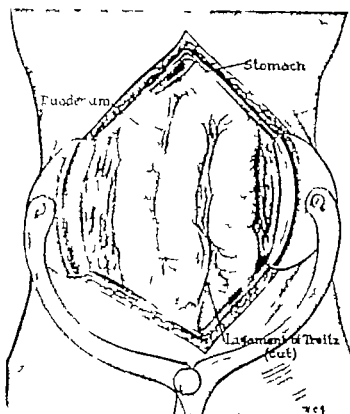


Fig. 2 The relative position and shortness of the afferent limb of the gastrojejunostomy is shown.

jejunal ulcers distal to the anastomotic line and always toward or in the first few centimeters of the efferent loop of the gastroenterostomy. Two of these ulcers are shown in Figures 4 and 5. The ulcers were chronic in appearance and they had rather shallow craters; they were hard indurated and did not tend to perforate.

Microscopically these ulcers are identical with those encountered in man under similar cir-

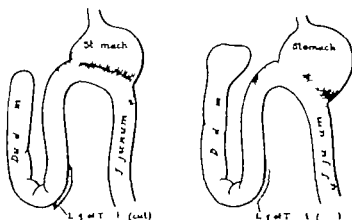


Fig. 3 A diagrammatic illustration of the operation performed in the 2 groups of dogs. The only difference in the 2 groups is the presence or absence of the pyloric antrum.



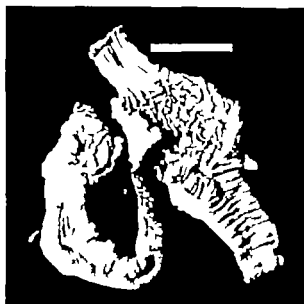


Fig. 4. Dog 45-38. Chronic marginal jejunal ulcer after 5 days of histamine-beeswax injections. Note position in efferent limb of anastomosis. The pyloric antrum has been excluded.

cumstances with a central zone of necrosis and granulation tissue, a surrounding area of acute and chronic inflammatory cell infiltration, and a varying amount of fibrosis. The microscopic appearance of such an ulcer is reproduced in Figures 6 and 7. The location of these ulcers emphasizes the pathway and mechanical factors concerned with the route of the acid gastric secretion.



Fig. 6. Dog 45-38. Low power photomicrograph showing extent of ulcer shown in Figure 4 after 2 days of histamine injection.  $\times 4$ .

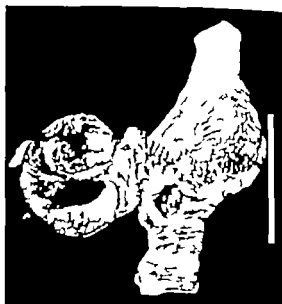


Fig. 5. Dog 46-48. Chronic marginal ulcer after 30 days of histamine-beeswax injections. The position is identical to that shown in Figure 4. The pyloric antrum has been excluded.

In the second group of 10 dogs 2 (20%) developed ulcers. These 2 dogs died of acute perforations early in the experiment without the formation of a chronic ulcer with its attendant gross and microscopic picture described above. One of these ulcers is shown in Figure 8. Most striking is the path of erosion of the gastric juice in the efferent limb.



Fig. 7. Dog 45-38. Typical picture of a chronic peptic ulcer with central necrosis and peripheral inflammatory cell infiltration and fibrosis.  $\times 65$ .

TABLE II—DOGS WITH PYLORIC ANTRA EXCISED

Number	Control weight pounds	Weight at death pounds	Days of histamine	Pathological findings
46-32	35	27	46	N evidence of ulcer
46-138	3	3	4	N evidence of ulcer
46-1	3 3/4	20	4	N evidence of ulcer
46-78	46	43	45	No evidence of ulcer
47-4	30	24	54	N evidence of ulcer
46-9	5	30		Perforated ulcer with multiple acute erosions
47-60	25	5	40	N evidence of ulcer
47-45	30	5	48	N evidence of ulcer
47-15	5	7	9	Perforated ulcer with multiple acute erosions
47-57	45	40	50	No evidence of ulcer

In the second dog that perforated in this series a similar picture was noted of an acute ulcer that was unlike the chronic ulcerations seen in the animals with pyloric exclusion.

The weight curves of the animals were an accurate guide to the condition of the animal. All animals lost 10 to 15 per cent of their body weight before their weight became constant after gastrectomy. The weight varied somewhat according to the habitus of the dog. If no ulcer developed there was relatively little weight change after the initial loss. This is illustrated in Figures 9 and 10.

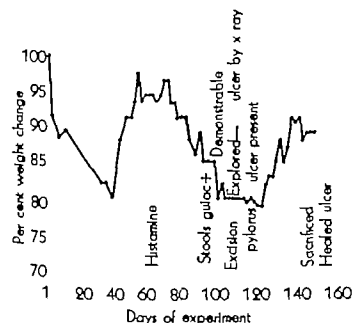


Fig. 9. Dog 45-26. Weight chart showing postoperative loss and recovery, a precipitous loss with development of an ulcer and prompt weight recovery with healing of ulcer.



Fig. 8. Dog 4-15. Acute perforated marginal ulcer after 9 days of histamine beeswax injection. Note the path of erosion along the gastric content along the entire margin of the anastomosis into the efferent limb. The pyloric antrum was excised.

Except for seasons of the year the experimental conditions and surgery of the two groups of animals were maintained identically. The only difference was the presence and absence of the pylorus. In 3 animals the pylorus was excised after an ulcer developed. In

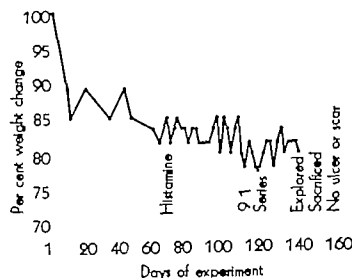


Fig. 10. Dog 46-49. Weight chart of an animal that did not develop an ulcer. Note the contrast with the chart in Figure 9.

2 of these healing resulted. In the third no effect was noted after excision of the pylorus and the dog had a very large indurated ulcer at postmortem examination. All animals showed a dilatation of the remaining portion of their stomachs with dilatation of the jejunum at the region of the anastomosis. These stomachs could accommodate up to 500 cubic centimeters of liquid without vomiting. Silk suture material sometimes protruded from the suture line but was never related to the ulcer anatomically. This has also been encountered by other investigators (74-77). Though there was no relation to the formation of an ulcer this finding suggests that very fine absorbable catgut is better material for the mucosal suture than silk.

#### DISCUSSION

In this group of experiments a direct pathological method was used to determine the effect of the pyloric antrum on the incidence of marginal ulceration in the dog. Conditions were maintained as identical as possible in both groups of animals. The results indicate that the pyloric antrum when excluded is responsible for a higher incidence (90%) of marginal peptic ulcers than when it is excised (20%) and that with pyloric exclusion the ulcers are chronic rather than acute. Incidental observations by other investigators in the course of different experiments confirm this conclusion. Steinberg (74) noted a 75 per cent incidence of marginal ulcers in dogs with the antra excluded. Fauley observed four marginal ulcers in a group of 12 dogs with pyloric exclusions. Dott and Lim noted an increased incidence of marginal ulceration under such circumstances. Masaki (55) using rabbits also noted an increased incidence of marginal ulcers with pyloric exclusions. McMaster and DeBailey using pyloric occlusions and gastroenterostomy of the Devine type noted a 6 per cent and 50 per cent incidence respectively of marginal peptic ulcers. These experiments are not comparable to the former group however as there had been no gastric resection and the pyloric exclusion was rather indefinite. The large group of clinical observations that implicate the pyloric antrum as a factor in marginal ulceration has been mentioned.

The experimental method may be questioned in that intramuscular histamine may be said to produce a maximal continuous response and therefore, the effect of any humoral factor of an intact pylorus would be negligible. This may be true particularly in consideration of the papers referred to where marginal ulcers were of higher incidence in animals with excluded pyloric antra without the use of histamine. However the incidence of marginal ulceration here with the use of histamine and pyloric antral exclusion is higher than in any other reported group of experimental animals. Furthermore it was felt that additional stimulation was necessary as a two-thirds gastric resection had been performed thus approximating the 75 per cent resection described by Wangenstein that protects the animal from a histamine ulcer. Another factor in this regard is the question of desensitization to histamine after a few weeks of daily injection. Thus the exact effect of histamine over a long period may be difficult to assay. It is interesting that peptic ulcers have been noted in man during histamine desensitization (McHardy).

Another factor of independent significance is the pepsin response to histamine. Linderström and his associates have definitely shown that there is pepsin secreted by the pyloric glands though less than in the glands of the body of the stomach. With resection of most of the pepsin secreting area of the body of the stomach the smaller amounts secreted by the pylorus may be of relatively much greater importance in combining with the acid secreted by the remaining and hypertrophied fundus and body of the stomach to form a marginal peptic ulcer. Many observers feel that pepsin is definitely stimulated by histamine. Babkin (8) however questions this, and wonders if this apparent increase in pepsin secretion may not be due to a washing out of pepsin already present by increased gastric secretion. He states the same opinion and considers that pepsin secretion is under direct vagal control.

The weight curves of these animals are interesting as they represent the summation of the anabolic and catabolic processes as related to intake and output. Clinically this has been stressed recently by Varco (78-79). No single weight in a dog is of significance nor in the

patient, as a 1 to 3 pound daily fluctuation may occur even though weights are measured at the same time. However the weight curve of several days, weeks or months may be and is of actually more value clinically than are many of the more elaborate laboratory tests. The charts previously shown are examples of this.

After review of much of the literature concerning the question of a gastric hormone and the physiological and surgical significance of the pyloric antrum one wonders why an excluded antrum increases the incidence of marginal ulcers. By exclusion the ordinary mechanical and chemical stimuli of the pylorus are removed with a certain decrease in the secretory response of the remaining stomach. On the other hand the stimulus to the pancreatic and biliary flow from the low pH and content of the normal stomach may be reduced by exclusion. This would result in a decreased flow of neutralizing duodenal content shown to be so important in the experimental work of DeBakey. Yet the use of a short afferent loop may expose the duodenum in a retrograde fashion to a fairly normal gastric secretion. The relation of pepsin to the total picture is not clear but as suggested it may be a deciding factor in the relative balance of exciting and neutralizing agents namely if acid pepsin mixtures are necessary for the production of an ulcer the additional pepsin secreted by the excluded pyloric antrum may be a most important factor.

#### SUMMARY AND CONCLUSIONS

1. An attempt to assay the rôle of the pyloric antrum in the incidence of marginal peptic ulcers has been made.

2. The literature concerned with the physiology of gastric secretion and particularly with the gastric phase of secretion has been reviewed. The pertinent literature concerning clinical observations on the rôle of the pyloric antrum has been included.

3. Experimentally the problem was approached directly utilizing 2 groups of 10 dogs. A subtotal gastrectomy was performed in each dog with the removal of approximately two-thirds of the stomach. An anterior Polya gas trojejunostomy was performed utilizing the

shortest possible afferent loop to the anastomosis by severing the ligament of Treitz and mobilizing the duodenum. In one group the pyloric antrum was excluded and left intact. In the second group the pylorus was resected. After a 2 month postoperative interval the dogs were injected daily with histamine in beeswax. Their daily weights, behavior, appetite and stools were followed with abdominal exploration when indicated. The incidence of marginal ulcers of the 2 groups of dogs was compared. Nine of 10 dogs (90%) with pyloric antra excluded developed chronic marginal ulcers. Two of 10 dogs (20%) without pyloric antra developed acute perforating marginal ulcers.

4. It is felt that the pyloric antrum definitely contributes to the increased incidence of marginal peptic ulceration.

5. The pyloric antrum should always be removed either at the same operation or at a second operation.

6. The mechanism of the increased incidence of marginal ulceration through exclusion of the pyloric antrum though discussed is not understood.

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### MALROTATION OF THE COLON

DEVELOPMENTAL errors in rotation of the colon sometimes play an important rôle in abdominal surgery. Mild abnormalities in position which are quite common may not only be compatible with good health but may remain undiscovered for many years, only to be observed during a routine x ray examination or at the time of an exploratory operation. However when the caliber of the bowel has been compromised, as from a volvulus or adhesions, one is confronted with a serious situation and operation is usually necessary for its relief. The underlying developmental error almost always involves the midgut and the classical picture is most often that of acute or chronic obstruction of the duodenum.

The basic factors in the normal process of bowel rotation have been admirably presented by several embryologists yet valuable contributions have been made from the clinical side by abdominal surgeons. We refer in particular to the writings of Frazer and Robbins of Lon-

don, Norman Dott of Edinburgh, William E. Ladd and Robert Gross of Boston, McIntosh and Donovan of New York, Gardner and Hart of Duke University, Raymond and Dragstedt of Chicago, Isabella Forshall of Liverpool and Rosenblatt of Portland, Oregon. The essential features of the process may be summarized as follows. About the fifth week of fetal life when the rapidly growing liver is disproportionately large for the size of the abdominal cavity, the *midgut* is pushed forward through the umbilical orifice and occupies a temporary position within the umbilical cord. While there over a period of about five weeks it undergoes a considerable change in length, the afferent or prearterial portion (extending from the duodenum to the vitelline duct) increasing very rapidly while the efferent or postarterial portion (made up of terminal ileum, ascending and two-thirds of the transverse colon) grows much more slowly. It undergoes also at the same time a rotation in a counterclockwise direction of about 180 degrees on its axis which is the superior mesenteric artery. This is known as the *first stage of rotation*.

During the *second stage of rotation* which is comparatively brief, the entire midgut returns to the abdominal cavity and in so doing it continues the process of rotation to a full 270 degrees, the jejunum entering the abdomen first and being followed in natural sequence by the loops of upper ileum as they pass behind the superior mesenteric artery from right to left and occupy their normal place in the left upper quadrant. As this rotation further progresses the lower coils of ileum come to be in the right lower quadrant, while the cecum and ascending colon swing forward in front of the

artery from left to right and gradually seek their normal place on the right side.

During the *third stage of rotation* which goes on slowly over a period of several months, the cecum slowly descends into the right iliac fossa, the ascending colon and descending colon become fused along the lateral gutters, the transverse mesocolon adheres to the lower part of the duodenum, the left transverse colon becomes somewhat stabilized by the gastrosplenic omentum while the sigmoid remains comparatively free. It is important to note that the root of the mesentery of the entire small bowel becomes firmly anchored along a broad oblique line from the left upper to the right lower quadrant.

It is easy to understand how any marked departure from this normal process of rotation and fixation might readily lead to serious trouble. If the midgut fails to return to the abdominal cavity and the child is born with it still protruding into the umbilical cord, an *exomphalos* is present, a serious situation but one not incompatible with life if surgery is performed immediately after birth. If during the first stage the midgut fails to rotate at all and returns to the abdomen through the wide open umbilical orifice *en masse* so to speak, a *non rotation* exists which in turn may either be followed by fixation of the bowel abnormally or because of a complete lack of fixation lead to a volvulus or twist of the entire midgut. If during the return of the midgut to the abdomen the rotation is in the clockwise direction with the cecum and ascending colon leading the way to pass under the artery from left to right, a *reversed rotation* has occurred which (though rare) when combined with lack of fusion may easily be followed by a twist of the midgut as great as 360 degrees. The term *malrotation* strictly speaking is that state of affairs that is present when either the normal counterclockwise rotation or the abnor-

mal clockwise rotation has been arrested before it is completed and one or more segments of bowel usually the cecum have become fixed by adhesions in an abnormal position.

From a *clinical* standpoint the end result is almost always an acute or chronic obstruction of the duodenum. Occasionally the onset of trouble is delayed for weeks, months, or even years and occasionally the onset is insidious with mild intermittent attacks of rhythmic abdominal pain, nausea and vomiting but in by far the majority of cases the picture is acute and comes on a few days after birth. The outstanding feature, of course, is the persistent vomiting of bile, and it is usually associated with fullness in the epigastrium and flatness of the lower belly. If however the obstruction is incomplete and intermittent in character the several loops of twisted midgut may contain much fluid and gas and a mass may be readily palpable. It must be remembered also that the twisted loops of bowel may be filled with venous blood and that if the neck of the volvulus is loose considerable of that blood may be passed by rectum. In making the diagnosis, the x ray film is sometimes of great help because a duodenum distended with air means obstruction in its lower part whereas the introduction of barium by Levine tube will clearly show the exact site and also the degree of narrowing. Air or barium when used from below are also of diagnostic value inasmuch as a normally filled colon speaks for an obstruction higher up and one that fills in its distal portion only gives one a strong clue that a volvulus of the midgut might be present.

Early surgery is the key to success and it consists essentially in untwisting a volvulus or completely severing abnormal adhesions associated with a malrotated colon. Through an ample incision the entire abdomen is explored

The distended duodenum is noticed at first glance and the absence of the colon in its normal place gives one an immediate clue as to the basic underlying pathology. Any adhesions or bands that bind the junction of the duodenum and jejunum are carefully divided until the normal caliber of the lumen is re-established, and a volvulus if present is slowly unwound and warm packs are applied until the congestion is relieved and normal color of the bowel returns. Gangrene fortunately is rarely present if operation is performed early and therefore resection is seldom necessary. Insurance against recurrence of obstruction is a difficult problem yet much may be accomplished in that direction by restoration of a malrotated gut to approximately its normal position and by fixing it there by properly inserted lines of sutures.

EDWIN M. MILLER

## CONGENITAL HYDRONEPHROSIS AND HYDROURETER

**A**BOUT 12 per cent of all individuals are born with some variety of urogenital tract malformation and of these approximately one in six has congenital obstruction in the upper urinary tract. It is with this last group that we are here concerned as factors in the genesis of hydronephrosis and hydroureter. With the exception of certain instances of neuromuscular dysplasia congenital dilation of the renal pelvis or ureter or of both results from obstruction. Renal excretion begins between the fifth and sixth month of fetal life and for this reason when obstruction exists advanced hydronephrosis and other urinary backpressure damage often exists at birth.

Stricture is by far the commonest congenital urinary obstruction and may occur in one form or another at any point from the prepuce

to a renal calyx. This includes congenital contracture of the vesical outlet. Secondary ureteral kinks and an altered angle of ureteral insertion into the pelvis are frequent and may compound the obstruction. Aberrant renal vessels sometimes compress the ureter either primarily or secondarily and rarely aberrant uterine vessels block the lower ureter. Occasionally the ureter is compressed by congenital bands or ureteral diverticulum. Urinary calculi though sometimes present at birth are acquired and not congenital.

Hydronephrosis results from continued urinary obstruction and when the blockage is below the ureteropelvic level there is hydro-ureter as well. In the development of hydronephrosis the earliest gross pelvic changes are noted in the minor calyces. As the pelvis and calyces dilate the parenchyma is increasingly compressed against the resistant fibrous renal capsule and the volume of the vascular supply and particularly of the capillary bed of the organ is correspondingly reduced. Trophic changes in the parenchyma result from anoxemia and anemia and there is tubular dilation, progressive parenchymal thinning, atrophy, sclerosis and diminution of function. Unrelieved the organ becomes a large dilated sac capped by a thin sclerotic rim of parenchyma which is of little or no functional value. Yet in most instances renal infection intervenes—probably most often hematogenous—and the diagnosis chronic pyelitis too often satisfies the physician. The advent of infection accelerates the destructive process.

In the earlier stages of hydronephrosis the renal change—a compression nephritis—is a reversible one. Elimination of obstruction and co-existing infection is commonly followed by return to essentially normal kidney function. When the obstruction is unrelieved or persistent ravaging therapeutically resistant infection has the upper hand the renal change be-



comes irreversible and usually nephrectomy is demanded. The renal lesion is readily identified by complete urologic examination. Persistent pyuria or pain or tumor along the course of the upper urinary tract is the usual indication for this investigation. In some instances the pain may simulate intra abdominal disease such as cholecystitis appendicitis intestinal obstruction and so forth and lead to needless laparotomy. The foregoing merits grave consideration because in a fourth of the cases of congenital supravescical obstruction the lesion is bilateral.

Congenital ureteral stricture occurs most often at the pelvic junction. This as well as congenital stricture in other body systems such as the biliary and intestinal tracts is simply an anomalous narrowing of the lumen and without induration or fibrosis except as subsequent inflammation or infection has occurred. These strictures usually involve only a short section of the ureter not over two to three millimeters long but may be elongated to one two or more centimeters. Usually the correct diagnosis is readily made by complete urologic examination but in some cases only renal exploration will demonstrate whether the obstruction is due to stricture aberrant vessel blockage at the pelvic outlet, ureteral compression by fibrous bands enlarged lymph nodes or purulent collections. Treatment is preferably conservative by ureteropelvicplasty when the renal damage is within limits of conservation. In our hands the Foley Schweizer ureteropelvicplasty has been the most satisfactory and has been employed successfully even when the only kidney of young children was involved. In about half of the cases the obstructive damage and particularly the ravages of infection demand nephrectomy. When the kidney is the only one and ureteropelvicplasty is technically impossible or impracticable we employ permanent nephrostomy.

Stricture below the ureteropelvic level occurs predominantly at the ureterovesical junction where it is bilateral in about a third of the cases. As a rule the dilation is greatest just above the stricture and this often acts as a buffer to spare the kidney the full harmful effects of the urinary backpressure. Where ureterorenal damage is not advanced stricture in the lower half of the ureter will usually respond satisfactorily to periodic progressive cystoscopic dilation with ureteral bougies. In dense ureterovesical junction stricture, cystoscopic division of the stricture or as the writer prefers transvesical incision through the open bladder and catheter intubation (No 12 to 14 F) for a week or so will promptly establish a widely patent channel through the stricture area. But successful operation to be thoroughly effective must be followed by periodic ureteral dilation sufficient to assure that free drainage exists. Plastic operations on the body of the ureter are generally unsatisfactory. When renal damage is therapeutically hopeless ureteronephrectomy is the procedure of choice and will be required in about 15 per cent of all cases of congenital stricture in the lower ureter of the young. All of the dilated ureter including the area of stricturation is excised with the kidney. When the opposite kidney is absent or will not support life and conservative treatment of the primary side is unsuccessful or offers an unjustified risk permanent nephrostomy is employed. Yet when the stricture is sufficiently distant from the kidney to permit a cutaneous ureterostomy will usually be more easily managed postoperatively.

Aberrant vascular obstruction commonly manifests itself in the young chiefly by persistent pyuria or pain in the side or both pyuria and pain. About 25 per cent of all kidneys have an anomalous blood supply with aberrant arteries, veins or both passing from

the upper pole, laterally from the cortex or downward or upward and medially from the lower pole. We are concerned here with the last group because they often cause primary or secondary obstruction of the upper ureter which they traverse. Transverse compression of the ureter by the anomalous vessel usually is urographically demonstrable and there is retention of opaque media above the obstruction. Yet the pyelogram as well as the clinical picture is sometimes indistinguishable from ureteropelvic junction stricture. In half of the cases of vascular ureteral blockage in children advanced renal damage requires nephrectomy. In the others compressing veins may be divided with impunity. If a compressing artery supplies more than a fourth of a kidney and therefore should not be cut, pelvicoplasty is done to alter the local anatomy sufficient to eliminate the obstruction. Anomalous vessels compressing the lower ureter are preferably divided; the alternative is ureteroneocystostomy or, with renal damage, ureteronephrectomy. MEREDITH F. CAMPBELL.

## HYPOSPADIAS

**S**UCCESSFUL surgical correction of hypospadias should result in first, normal sexual function; second, a urethral channel of good caliber; third, a meatal opening that is at or very near the normal location of this opening in the glans penis.

It is a well recognized fact that the treatment of hypospadias is a peculiarly difficult problem. This was aptly phrased by Higgins who said, "Hypospadias is a grievous deformity which must ever move us to the highest surgical endeavor. The refashioning of the urethra offers a problem as formidable as any in the wide field of our art."

Many methods of surgical treatment have been described in the literature but no writer

has been willing to give a statistical analysis of a series of cases to show the percentage of good results obtained. The variety and number of operations proposed together with the lack of any analytic report of results would seem to indicate that surgeons concerned with the problem still are seeking a better solution of it.

In 1937 McIndoe<sup>1</sup> discussed the use of Edmunds' operation for correction of chordee, and also the use of an inlying tubular (or tunnel) graft for restoration of the missing portion of the urethral channel. The inlying tubular graft method for restoration of the urethral channel appears to offer the possibility of particularly gratifying results. There has come to our attention an as yet unpublished report of use of the method in 29 cases of major hypospadias during the past five years. Judged according to the criteria set forth in the opening paragraph of this editorial, good results were obtained in 27 cases; a fair result was secured in 1 case and there was only 1 failure. This is evidence of encouraging progress in the management of a most difficult problem.

Best results are obtained with the inlying tubular graft if the graft is not inserted until the patient has reached the age of about 16 years. Acceptance and use of this method of treatment will require a change in the attitude of many physicians regarding the age at which correction should be made. Many physicians argue that correction should be made when the patient is at an early age because of fear that the presence of the deformity will lead to psychic disturbances. Great pressure often is brought to bear by parents and others because of the same fear to have the surgeon undertake the correction when the patient is at an early age. Careful observation of a considerable number of boys at the age of puber-

<sup>1</sup>McIndoe, A. H. *Am. J. Surg.*, 93: 35, 176-185.

ty who had hypospadias and who had not had their deformity corrected did not reveal any with psychopathic tendencies. It would seem more reasonable to anticipate the possibility of a psychosis a little later when the patient may contemplate marriage. It is of course true that the necessity for delay of full correction until the patient is 16 years old will lead to definite difficulties with which the boy must contend before he reaches that age. When he is 10 or 12 years of age however he should be old enough to understand his prob-

lem and a frank discussion of it together with an explanation of the plans for correction at the proper time will enable him to manage his difficulties satisfactorily.

There is no contraindication to and there are some advantages in correction of chordee in childhood but the use of the inlying tubular graft should be deferred until the patient has attained the age of 16 years. If desired the whole program can be deferred until puberty without fear of disadvantage.

FRED Z. HAVEAS.

# THE SURGEON'S LIBRARY

## REVIEWS OF NEW BOOKS

THE *History of Medicine* by Cecelia C. Mettler<sup>1</sup> is actually fifteen histories of the scientific and medical specialties which compose the sum total of medical knowledge. In other words the history of anatomy from ancient times to the present is given in two sections. The history of physiology from the seventeenth century through the nineteenth century is given in another section and similarly pharmacology, pathology and bacteriology have their own chapters in the work.

The field of physical diagnosis is covered from the time of the medicine man to that of the present physical scientists. Following this medicine is taken up from the stages of development in the Assyrian and Egyptian periods down to modern times. Neurology and psychiatry then are studied from the pre-Grecian period through the nineteenth century. Venereology has a separate section. Dermatology is also set aside as is pediatrics.

Surgery has a long series of chapters beginning with a discussion of trephining as carried out in the primitive human society of the Cro-Magnon period and reaching down to the end of the nineteenth century. Obstetrics and gynecology, ophthalmology and otology and rhinolaryngology each have their separate sections. The pages are filled with the names of the individual workers in all these specialties and each page contains numerous footnotes and references about them. Each chapter of each section ends with a series of selected readings giving not only modern references but a large list of reference works and texts. This is all incorporated in a single volume of a little over twelve hundred pages. This is thoroughly indexed both as to subject matter and as to personal names appearing in the text. Thus one may turn to the work to look up any individual physician or authority in the entire field of medicine and its allied sciences. One is impressed with the condensation of an immense amount of knowledge.

The book was edited by Professor Fred A. Mettler who says in his preface. It is one of the functions of the historian to preserve and explain the continuity of the present with the past. The greatest obstacle to medical progress and indeed to all cultures is the loss of this continuity with the past. Such a work as this certainly facilitates this continuity and enables one to learn easily of the work in almost any field in which he might be interested.

Many of the original classical authors in medicine are quoted extensively so that the work in this volume includes much of the original writings of the past. This adds to the realism and romance as well as providing precise information in regard to the earliest works. In the author's conclusion a sentiment is expressed with which the reviewer heartily concurs. The larger liberal and practical advantage to be derived from the study of the history of medicine are many and many of these will have become apparent to the student who has perused the preceding pages with care.

PAUL STARR

IN the second edition of his book on surgical disorders of the chest Dr. Donaldson<sup>2</sup> has done a remarkable piece of work in getting into the confines of this relatively small book a complete survey of the subject. Furthermore there are numerous references to work that has not yet been published. Thus the reader is brought the latest opinions available on a number of important subjects.

All of the conditions of the chest for which surgery can be used have been covered. The lessons learned in the recent war are discussed in some detail and their application to peacetime surgery emphasized.

There are certain sections of the book that are not clear especially that dealing with empyema. The author ignores the literal meaning of empyema and even discusses pyogenic empyema. Although he writes at considerable length about the pathogenesis of different types of empyema he has nothing to say about the manner in which localization occurs. In discussing non-purulent pure tuberculous empyema he misquotes Head and outlines the treatment of this condition as if it were a mixed infection.

The section on pericarditis is very good in so far as the consideration of the acute forms is concerned. He himself has made notable contributions to this subject. However in discussing chronic constrictive pericarditis he fails to make any reference to the pioneer work of Schmieden in Germany and of Beck and Churchill in this country. Also he fails to list increased venous pressure among the signs of the disease.

There are a number of other statements with which this reviewer would take issue. Among these are that bronchography by the direct injection of oil into the trachea should not be done and that, to know empyema is to know chest surgery. More upsetting

<sup>1</sup>*HISTORY OF MEDICINE. A CORRELATIVE TEXT, ARRANGED ACCORDING TO SUBJECTS.* By Cecelia C. Mettler. A. B. Ed. B. A. M. Ph.D. Edited by Fred A. Mettler. A. M. M. D. Ph.D. Philadelphia and Toronto: The Blakiston Co., 1947.

<sup>2</sup>*SURGICAL DISORDERS OF THE CHEST. DIAGNOSIS AND TREATMENT.* By J. K. Donaldson, B.S., M.D. F.A.C.S. 2nd ed. Philadelphia: Lea & Febiger, 1947.



record of the medicine man the sweat houses the counterirritants and the medical and surgical practices of these primitive people. It is surprising to learn that the Indians added fifty-nine drugs to our pharmacopoeia that they successfully performed amputations using hot stones to control bleeding that they set fractures and sutured wounds. For all their superstitions and fetiches, one gets the impression that their patients often may have fared as well as those in the hands of the pioneer white physician with his rough and ready surgery his blood letting and his violent cathartics. Certainly the advent of the white man was no blessing to the Indian. With the whites came diseases which apparently were new to the Indian and to which he had relatively little immunity. Venereal disease measles scarlet fever tuberculosis and small pox were among these. In some of the early epidemics of small pox Indian tribes were decimated, and whole villages were depopulated.

In the next three chapters appears the story of medical men coming to Oregon with the Hudson's Bay Company, as missionaries to the Indians and as immigrants in the period of early American settlement. Towering among these figures is Dr. John McLoughlin, known to the Indians as the White Headed Eagle. Here too is the medical missionary Marcus Whitman, and the story of his death at the hands of the Indians he was trying to serve. The story includes a consideration of the factors which apparently led to the Whitman massacre. These first five chapters are the most interesting part of the book. An authoritative report has been woven into an absorbing story in which the whole history of medicine seems to be recapitulated.

Chapter six gives the history of medical men in each county of the State. Except for an occasional bright spot in which is described some individual doctor's peculiarities or some event in his practice this chapter is as unexciting as reading a dictionary. The last half of the book depicts the progress of medical education in Oregon. It tells of the development of a medical school medical societies and journals hospitals and institutions for the care of patients with communicable diseases. For the medical historian these chapters are a gold mine of exhaustive information. For the casual reader they are definitely "hard reading." On the other hand, this section conveys something to the reader that is not immediately apparent. Hidden in the factual data and its careful documentation is the story of man's growing sense of his obligation to his fellow man. Whether the discussion deals with insanity tuberculosis or epidemic disease there is apparent a gradual recognition of the need for caring for the sick and protecting the well the acceptance of an obligation and the struggle to find the ways and means by which this obligation may be creditably discharged.

Dr. Larsell is imminently qualified to write this book. He grew up in the Pacific Northwest received his schooling in Oregon and his life work has been the teaching of medical students in that state. He

has always been interested in medical history and this book represents the culmination of a quarter of a century of devoted research. W. K. LIVINGSTON

THIS monograph *Ulcers of the Stomach and Duodenum* by Edmundo Vasconcelos of 125 pages and 154 illustrations is printed on excellent paper and with type large enough to be easily read. Many of the illustrations are truly superb.

The author knows this subject cannot be covered in detail in a monograph and states in the Foreword:

After twenty years of work in this field and having performed over 1000 operations for ulcer disease I have reached definite conclusions which I believe worth publishing. Since this book is exclusively intended to be presented at a meeting of specialists such as the 11th Congress of the International Society of Surgery (London 1937) all work and ideas already published as well as all the bibliographic quotations have been omitted. Its only aim is to establish the technical orientation of the author and must be strictly considered as a personal point of view.

It is obvious that Professor Vasconcelos has learned much from over 1000 surgical interventions for ulcer disease and that he has been influenced largely by the Continental school of surgeons particularly Austrian and German. American teachings publications and opinions have been of relatively minor importance. He has apparently pioneered and from experience learned which procedures survive the acid test of time these he has adopted and recommends.

The closure of the duodenum after a gastric resection by the double purse string method is therefore recommended though many American surgeons have found it hazardous and difficult. The anatomy of the upper gastrointestinal tract is carefully described and given a significant rôle in this text. The translation from Spanish to English is well done but nomenclature is occasionally confusing especially when used for instruments and surgical procedures having other names in English. Nothing new to the literature on surgical therapy for gastroduodenal ulcer is found in this text but surgical therapy advised by other authorities in this field and found satisfactory by the author merits repetition.

S. J. FOOKLSON

DESIGNED for the general practitioner Colwell's *Diabetes Mellitus in General Practice* is clearly written and up to date. Especially well presented are the early chapters on the general characteristics diagnosis and general treatment of diabetes. The method of diet calculation used by the author is described and in the chapter on insulin and its modifications his work with insulin mixtures is summarized. The book is recommended as a concise practical and readable discussion of diabetes mellitus.

WALTER H. NADLER

ULCERS OF THE STOMACH AND DUODENUM. TECHNIQUE OF SURGICAL TREATMENT. By Edmundo Vasconcelos, M.D. F.A.C.S. Sao Paulo, Brazil. Edit. de Rev. e. S. A. 947. DIABETES MELLITUS IN GENERAL PRACTICE. By Arthur R. Colwell, M.D. Chicago: The Year Book Publishers, Inc. 947.



# CLINICAL CONGRESS OF AMERICAN COLLEGE OF SURGEONS

ARTHUR W ALLEN *Boston President*  
DALLAS B PHEMISTER *Chicago President-Elect*

## PRELIMINARY PROGRAM FOR 1948 CLINICAL CONGRESS THE BILTMORE HOTEL, LOS ANGELES OCTOBER 18 22 1948

THE thirty fourth Clinical Congress of the American College of Surgeons will convene in Los Angeles during the five days, October 18 to 22. The surgeons of that great city whose importance as a medical center is growing along with its spectacular increase in population are enthusiastically planning a comprehensive program of operative clinics and demonstrations to be held in local hospitals. Some of the operations will be telecast from the Los Angeles County General Hospital to a large room on the lower level of the Biltmore Hotel. The clinicians at some twenty five participating hospitals have arranged programs which will incorporate the latest advances in surgical technique and operative procedures. A preliminary schedule of the clinics demonstrations, and other presentations to be given at the hospitals appears in the following pages. These will be finally revised and amplified immediately preceding the Congress. A complete detailed program will be published each day for the succeeding day in the form of *Daily Bulletins* which will be distributed at the Headquarters hotel, The Biltmore.

The sessions at the Biltmore Hotel, the adjacent Biltmore Theater and the Philharmonic Auditorium across the street, will, like the clinics in the hospitals, include subjects in general surgery obstetrics and gynecology fractures orthopedic surgery, thoracic surgery neurosurgery genitourinary surgery and ophthalmology and otorhinolaryngology. Several official meetings are also scheduled. A series of Hospital Standardization conferences will be held for four days from Monday through Thursday. As stated previously telecasts of operations will be shown. There will be the usual impressive display of scientific and technical exhibits.

### PRESIDENTIAL MEETING

The opening evening session of the Clinical Congress will be devoted to the Presidential Meeting at which the officers-elect, consisting of Dr Dallas B Phemister of Chicago as president Dr Howard A Patterson of New York as first vice president, and Dr Carl H McCaskey of Indianapolis as second vice president will be installed. Dr Arthur W Allen of Boston outgoing president and vice-chairman of the Board of Regents will preside and will deliver the Presidential Address. The third Martin Memorial Lecture will be delivered by Dr Clarence Crafoord, professor of surgery University of Stockholm. Dr Crafoord's subject will be Some Aspects of the Development of Intrathoracic Surgery.

The Annual Convocation will be held on the final evening Friday. The formal initiation ceremonies and the presentation of the Fellowship Address by Dr L. A. Du Bridge, president California Institute of Technology. Pasadena will constitute the program. Dr Du Bridge's subject will be, The Physicist Meets the Doctor.

### ASSEMBLY OF INITIATES

The 1948 initiates will attend an assembly on Friday afternoon from 1:30 to 2:15 o'clock in the Temple Baptist Church. Dr Dallas B Phemister incoming president of the College, will preside. Dr Irvin Abell chairman of the Board of Regents and Dr Bowman C. Crowell and Dr Malcolm T. MacEachern associate directors will briefly outline the program of the College.

### OTHER OFFICIAL MEETINGS

The annual meeting of the Governors and Fellows of the College will be held on Thursday after



noon at 1 30 o'clock. Reports on activities of the American College of Surgeons will be presented by the officers and chairmen of the standing committees, followed by the election of officers.

Meetings of three important committees will be held on Wednesday as follows: State and Provincial Executive Committees, 9:00 to 10:00 a.m.; State and Provincial Credentials Committees and Committees on Applicants and Judiciary Committees, 10:00 to 11:00 a.m.; and National and Regional Fracture Committees, 3:30 to 5:00 p.m. The Committee on the Library will be held on Thursday from 3:00 to 4:00 p.m. A dinner for the Committee on Fractures and Other Traumas, and chairmen of the Regional Committees, will be held from 6:00 to 8:00 p.m. on Thursday.

#### FORUM ON FUNDAMENTAL SURGICAL PROBLEMS

The Forum on Fundamental Surgical Problems, one of the most popular features of Clinical Congresses during the past few years, will be held on Tuesday through Friday, mornings, in two sections meeting concurrently. Brief reports of original clinical and experimental observations relating to the broad aspects of surgery and the surgical specialties will be presented under the general direction of Dr. Owen H. Wangensteen, chairman of the committee Forum on Fundamental Surgical Problems.

#### EVENING SCIENTIFIC SESSIONS— GENERAL SURGERY

"Malignant Lesions of the Thyroid Gland" will be the subject of the Tuesday evening general surgery symposium. "Histologic Types of Thyroid Carcinoma and their Clinical Significance" will be discussed by Dr. Frank W. Foote of New York, "Aberrant Thyroid," by Dr. Brien T. King of Seattle. "Malignancy in Nodular Goiter" by Dr. Warren H. Cole of Chicago and "Radioactive Iodine for the Treatment of Thyroid Disease Including Cancer" by Dr. Myron Primmett, Los Angeles.

"Endometriosis" will be the subject for the Wednesday evening general surgery symposium. "The Medical Treatment and Significance of Endometriosis," will be discussed by Dr. Joe V. Meigs of Boston. "Surgical Procedures Involved in the Treatment of Endometriosis," by Dr. Virgil S. Counsellor of Rochester, Minnesota, and "Etiology of Endometriosis," by Dr. Brooks Ranney of Chicago. The annual Fracture Oration will also be presented at the Wednesday evening session.

"Surgery of the Heart and Great Vessels" will be the subject of the Thursday evening general surgery symposium. "Surgical Treatment of Pul-

monic Stenosis," will be discussed by Dr. Alfred Blalock of Baltimore. "The Surgical Treatment of Constrictive Pericarditis," by Dr. Emile F. Holman of San Francisco. "The Surgery of Patent Ductus Arteriosus," by Dr. John C. Jones of Los Angeles and "Treatment of Coarctation of the Aorta," by Dr. Robert E. Gross, Boston.

#### EVENING SCIENTIFIC SESSIONS—OPHTHALMOLOGY

The preliminary program for the Tuesday evening Ophthalmology session includes the following subjects: "Tumors of the Eyelids and the Conjunctiva" by Dr. Michael J. Hogan of San Francisco, "Partial Keratectomy," by Dr. George L. Kilgore of San Diego, and the Third paper will probably be on "Studies of the Cytology of Conjunctival Exudates."

The Wednesday evening program will be devoted to a panel discussion on the subject: "Neoplasms of the Eyelids, Orbit, Nose, and Accessory Sinuses—Treatment and Plastic Repair" and will be participated in jointly by ophthalmologists and otorhinolaryngologists. Dr. Gordon B. New of Rochester, Minnesota, will be the moderator.

The program for the Thursday evening Ophthalmology session includes the following subjects: "Retinal Detachment" by Dr. Dohrmann K. Püchel of San Francisco, "The Use of Retrobulbar Alcohol Injection for Ocular Pain" by Dr. Alfred E. Maumenee of Baltimore, and a third paper is not yet definitely selected.

#### EVENING SCIENTIFIC SESSIONS— OTORHINOLARYNGOLOGY

The preliminary program for the Tuesday evening Otorhinolaryngology session includes the following subjects: "Effects of Streptomycin on Eighth Nerve Function" by Dr. Page Northington of Oakland, "Anatomical Considerations in Ear Surgery" by Dr. J. Brown Farnor of Tampa, and "Chronic Laryngeal Stenosis," by Dr. John B. Erich of Rochester, Minnesota.

The Wednesday evening program will be devoted to a panel discussion on the subject: "Neoplasms of the Eyelids, Orbit, Nose and Accessory Sinuses—Treatment and Plastic Repair" and will be participated in jointly by ophthalmologists and otorhinolaryngologists. Dr. Gordon B. New of Rochester, Minnesota, will be the moderator.

The program for the Thursday evening Otorhinolaryngology session includes the following subjects: "Present Day Status of Fenestration Surgery" by Dr. Leighton F. Johnson of Boston, "Tumors of the Nasopharynx," by Dr. Harry C.

Rosenberger of Cleveland Modern Management of Oro-Antral Fistula by Dr Richard Thomas Barton of Beverly Hills and Surgical Treatment of Laryngeal Cancer by Dr Chevalier L. Jackson of Philadelphia

#### GENERAL SURGERY PANEL DISCUSSIONS

General surgery panel discussions will be held on Monday, Tuesday and Wednesday after noons, from 1:30 to 3:00 and from 3:30 to 5:00 o'clock and on Thursday afternoon from 3:30 to 5:00. The early session on Monday will be on Acute Renal Failure in Surgical Patients, with Dr Frederick A. Collier of Ann Arbor as moderator and the late session on Tumors of the Mouth, Jaw and Face, with Dr Gordon B. New of Rochester, Minnesota as the moderator. The early session on Tuesday will be on Low Lying Malignant Lesions of the Bowel with Dr Fred W. Rankin of Lexington, Kentucky as moderator and the late session on Evaluation of Liver Function in Relation to Surgery with Dr Nathan A. Womack, Iowa City as moderator. The early session on Wednesday will be on Peripheral Arterial Disease with Dr Alton Ochaner of New Orleans as moderator and at the late session 'Ulcerative Colitis' will be discussed, with Dr Henry W. Cave of New York as moderator. The Thursday session will be concerning Isotopes in Surgery with Dr George M. Curtis of Columbus as moderator.

#### OPHTHALMOLOGY PANEL DISCUSSIONS

Panel discussions in ophthalmology will be held Tuesday, Wednesday and Thursday mornings from 9:00 to 10:30 o'clock. The Tuesday subject will be Surgical Management of (1) Acute Inflammatory Glaucoma, (2) Chronic Simple Glaucoma, (3) Congenital Glaucoma, with Dr A. Ray Irvine of Los Angeles as the moderator. The Wednesday subject will be Congenital Cataract, with Dr Otto Barkan of San Francisco as moderator. The Thursday subject will be Surgery of the Oblique Muscles with Dr C. Allen Dickey of San Francisco as the moderator.

#### OTORHINOLARYNGOLOGY PANEL DISCUSSIONS

Panel discussions in otorhinolaryngology will be held Tuesday, Wednesday and Thursday mornings from 10:45 to 12:15 o'clock. The Tuesday subject will be 'Rehabilitation of the Hard of Hearing' with Dr Walter P. Work of San Francisco as moderator. The Wednesday subject will be 'The Preparation of the Surgical Patient and Postoperative Care' with Dr Colby Hall of Los Angeles as moderator. The Thursday subject for

discussion will be Diseases of the Esophagus with Dr Alden H. Miller of Los Angeles as moderator.

#### SPECIALTY PANEL DISCUSSIONS

Specialty panel discussions will be held on Friday afternoon from 1:30 to 3:00 and from 3:15 to 4:45 o'clock as follows:

*Urology*—Moderator DR. REED M. NESBIT, Ann Arbor

1:30 to 3:00 p.m.—Present Day Management of Urinary Tract Infections

3:15 to 4:45 p.m.—The Clinical Management of Branched Renal Calculi

*Orthopedic Surgery*—Moderator DR. JOHN C. WILSON, Los Angeles

1:30 to 3:00 p.m.—Mechanical Derangements of the Knee Joint

3:15 to 4:45 p.m.—Fractures about the Hip

*Thoracic Surgery*—Moderator DR. FRANK S. DOLLEY, Los Angeles

1:30 to 3:00 p.m.—Diagnosis and Surgical Treatment by Pulmonary Resection for Carcinoma, Bronchiectasis and Tuberculosis.

3:15 to 4:45 p.m.—Surgery of the Esophagus.

*Plastic Surgery*—Moderator DR. TRUMAN G. BLOCKER, JR., Galveston

1:30 to 3:00 p.m.—Congenital Facial Deformities

3:15 to 4:45 p.m.—Burn Contractures of the Extremities.

*Gynecology and Obstetrics*—Moderator DR. JOHN C. BURCH, Nashville

1:30 to 3:00 p.m.—Hysterectomy: Physiological Considerations—Indications.

3:15 to 4:45 p.m.—Hysterectomy: Technical Considerations—Complications.

*Neurological Surgery*—Moderator DR. HOWARD C. NAFFZIGER, San Francisco

1:30 to 4:45 p.m.—Cerebral Angiography  
a Anatomical Interpretations of Angiography

b Characteristic Patterns of Angiography in Brain Tumors.

c Angiography of Circulatory Lesions and Their Treatment.

d Technique and Materials.

#### AFTERNOON SYMPOSIA

Symposia on Cancer Clinics and Cancer Detection Centers, and on Fractures and Other Traumas, will be held in the Ballroom and in the Biltmore Theater respectively on Tuesday afternoon from 2:00 to 5:00 o'clock. A symposium

on Graduate Training in Surgery will be held in the Ballroom on Thursday afternoon from 3:00 to 5:00 o'clock.

#### HOSPITAL STANDARDIZATION CONFERENCES

The twenty-seventh annual Hospital Standardization Conference which is an integral part of the Clinical Congress, will provide an opportunity for thorough discussion of many problems incident to hospital care of the patient. The sessions will be of vital interest to members of medical staffs of hospitals, trustees, administrators, nurses, and other executive personnel. During the four day conference selected authorities from various fields of hospital work will participate in the program.

The conference will open at 10:00 a.m. on Monday, October 18, in the Ballroom of the Biltmore Hotel with a joint meeting for surgeons and hospital representatives. Among the subjects which will be discussed at this and later sessions will be: The Point Rating System of the American College of Surgeons, Professional Accounting—the Medical Audit, Utilization of Nurses, Aides, Planning, Organization, and Management of a Modern Admitting and Emergency Department, Administrative Aspects of the Early Ambulation of Patients, the Personality Factor in Hospital Management, Coordination of Activities of Doctors, Administrators, and Trustees, Organization and Work of the Surgical Committee, and Advantages of Having Medical Staff Offices in the Hospital.

An especially interesting type of session, inaugurated at last year's Clinical Congress in New York, will be a Forum on Fundamental Problems in Hospital Administration, conducted in a way similar to the Forum on Fundamental Surgical Problems—that is, recent graduates from schools of hospital administration, who are now doing administrative work, will submit abstracts on subjects of current interest from which will be chosen some ten or twelve speakers who will present the discussions.

#### COMMITTEE ON ARRANGEMENTS

The Committee on Arrangements for the Clinical Congress in Los Angeles has been well organized and is actively functioning. The membership follows:

##### General Committee

Donald G. Tollefson, M.D., F.A.C.S., *Chairman*  
Hugh T. Jones, M.D., F.A.C.S., *Vice-Chairman*  
Harold Lincoln Thompson, M.D., F.A.C.S., *Secretary*  
*Treasurer*  
Gilbert J. Thomas, M.D., F.A.C.S., *Represent of the College*  
F. Vincent Akey, M.D., F.A.C.S.  
Ma. W. Bay, M.D., F.A.C.S.  
J. MacKenzie Brown, M.D., F.A.C.S.

Lawrence Chaffin, M.D., F.A.C.S.  
A. Ray Irvine, M.D., F.A.C.S.  
Maurice Kahn, M.D., F.A.C.S.  
W. E. MacPherson, M.D.  
B. O. Rankston, M.D.  
Louis J. Regan, M.D.  
Carl Roehle, M.D., F.A.C.S.  
Stafford Warren, M.D.

#### Committee for the Southern California Chapter

Ray B. McCarty, M.D., F.A.C.S., *Rhode*  
Meredith G. Beaver, M.D., F.A.C.S., *Redlands*  
Clarence L. Rees, M.D., F.A.C.S., *San Diego*  
Carl G. J. Ineson, M.D., F.A.C.S., *Long Beach*  
James H. Saint, M.D., F.A.C.S., *Santa Barbara*

#### Hospital Committee

The members of the hospital committee are listed on succeeding pages with the list of hospitals participating in the clinical program.

#### MEDICAL MOTION PICTURES

An appreciated feature of the Clinical Congress will again be the showing of medical motion pictures each day. The latest available pictures on surgery and related subjects will be presented. Special showings will be arranged of medical motion pictures in the fields of ophthalmology and otorhinolaryngology. Both sound and silent films will be shown, all of which will have been approved by the Committee on Motion Pictures. Some of the newer medical motion pictures now under production will be shown.

#### TECHNICAL AND SCIENTIFIC EXHIBITIONS

The Technical and Scientific Exhibits will occupy the Ballroom foyer, the Renaissance Room, and the Galleria of the Biltmore Hotel, according to present plans. Leading manufacturers of surgical instruments, x-ray apparatus, sterilizers, operating room lights, ligatures, dressings, hospital apparatus and supplies of all kinds, and pharmaceuticals, and publishers of medical books will be represented.

#### ENTERTAINMENT FOR VISITORS

The Committee on Arrangements is planning a most interesting program for the wives and other guests of Fellows who are attending the Clinical Congress. Among the events planned are a luncheon at Cocoanut Grove with a style show and other entertainment, tours to the Hollywood studios, to radio stations, to the Huntington Library, to Mount Wilson Observatory, to Griffith Park Observatory, and to the residential districts in which are situated the homes of motion picture stars.

A special registration desk will be provided for guests. A fee to cover the costs of the tours and

entertainment will be charged which will amount, according to the present estimate to \$10.00 for the four days beginning Tuesday morning. Since the committee in charge needs to determine in advance how many persons wish to be included in the various events, registration is desired by mail as soon as possible.

#### ADVANCE REGISTRATION

Surgeons who wish to attend the Congress should register in advance. Under a new plan advance registration will greatly expedite the procedure of registering.

No registration fee will be charged. Fellows whose dues are paid to December 31, 1947. For endorsed Junior and Senior Candidates the fee will be \$5.00. Non-Fellows who after individual consideration are permitted to register will pay a fee of \$10.00.

No registration fee will be required of initiates of the class of 1948.

#### HOTEL RESERVATIONS

It is desirable to make hotel reservations as early as possible because of the shortage of hotel rooms that prevails in Los Angeles as well as in other cities. In making these communications should be addressed to the Los Angeles Convention and Visitors Bureau, care of the Los Angeles Chamber of Commerce, stating that you will be attending the Clinical Congress of the American College of Surgeons. All hotel reservations for the Clinical Congress are to clear through this Bureau. No correspondence should be sent directly to the hotels. A form for reservations was enclosed in the letter recently sent to Fellows. Choice of hotels may be designated. The hotels in Los Angeles require a deposit in advance.

There follows the list of member hotels, Convention and Visitors Bureau, Los Angeles Chamber of Commerce.

#### LOS ANGELES HOTELS

	Rates (as of May 15, 1948)	
	Double	Subject to change Twin
Alexandria, 210 West 5th St.	\$ 6.00 up	\$ 7.00 up
Ambassador		
3400 Wilshire Blvd.	\$10.00-17.00	\$10.00-17.00
Biltmore, 515 South Olive St.	\$ 7.50-12.00	\$ 7.50-12.00
Chancellor, 3101 West 7th St.	\$ 4.50- 6.00	\$ 4.50- 6.00
Chapman Park		
340 Wilshire Blvd.	\$ 6.00- 7.00	\$ 7.00- 8.00
Clark, 420 South Hill St.	\$ 4.50- 5.00	\$ 5.50- 6.00
Commodore		
1203 West 7th St.	\$ 3.00- 3.50	\$ 4.00
Elmer, 235 South Hope St.	\$ 3.00	\$ 3.00
Figueras		
930 South Figueroa St.	\$ 3.00- 4.00	\$ 5.00
Gates, 6th and Figueroa Sts.	\$ 3.50- 6.00	\$ 3.50- 6.00
Gaylord, 3355 Wilshire Blvd.	\$ 7.50 up	\$ 7.50 up
Hayward, 6th and Spring Sts.	\$ 5.00	\$ 5.50
Hollywood Drake		
6724 Hollywood Blvd.	\$ 3.50 up	\$ 4.50 up
Hollywood Hotel		
Hollywood at Highland.	\$ 5.00- 6.00	\$ 5.00- 6.00
Hollywood Knickerbocker		
1014 1st St.	\$ 6.00 up	\$ 6.00
Hollywood Plaza		
1637 No. Vine St.	\$ 4.00 up	\$ 4.50 up
Hollywood Roosevelt		
7000 Hollywood Blvd.	\$ 7.00 up	\$ 8.00 up
Kipling, 4077 West Third St.	\$ 3.00	\$ 3.50- 4.00
Lankershim, 230 West 7th St.	\$ 3.00- 4.50	\$ 4.50- 7.00
Mayan, 3049 West 8th St.	\$ 4.00- 5.50	\$ 5.00- 5.50
Mayfair, 1250 West 7th St.	\$ 5.00 up	\$ 6.00- 7.00
Natick, 108 West 1st St.		
Rosslyn, 111 West 5th St.	\$ 4.00- 8.00	\$ 4.50- 9.00
San Carlos		
507 West 5th Street	\$ 4.50	\$ 6.00
Savoy		
6th St. and Grand Ave.	\$ 3.50- 5.50	\$ 4.50- 5.00
Town House		
630 Commonwealth Ave.	\$14.00	\$14.00

### CLINICAL CONGRESS PROGRAM IN BRIEF

#### Monday, October 18

- 8:00-12:00 Clinics and Demonstrations—Local Hospitals
- 10:00-12:30 General Assembly—Ballroom
- 1:30-3:00 Panel Discussion—Philharmonic Auditorium
- 2:00-4:00 Television Surgical Specialties—Foyer Biltmore Bowl (Lower Level)
- 2:00- 5:00 Clinics and Demonstrations—Local Hospitals
- 2:00- 5:00 Hospital Conference—Ballroom
- 2:00- 5:00 Surgical Film Exhibition (General)—Biltmore Theater
- 3:30- 5:00 Panel Discussion—Philharmonic Auditorium
- 8:15-10:30 Presidential Meeting—Philharmonic Auditorium

#### Tuesday, October 19

- 8:00-12:00 Clinics and Demonstrations—Local Hospitals
- 8:30-12:30 Forum on Fundamental Surgical Problems—Philharmonic Auditorium

- 8:30-12:30 Forum on Fundamental Surgical Problems—Ballroom
- 9:00-10:30 Panel Discussion Ophthalmology—Conference Room No. 1
- 9:30-12:30 Hospital Conference—Music Room
- 9:30-12:30 Surgical Film Exhibition (General)—Biltmore Theater
- 10:00-12:00 Television General Surgery—Foyer Biltmore Bowl
- 10:45-12:15 Panel Discussion—Otorhinolaryngology—Conference Room No. 1
- 1:30- 3:00 Panel Discussion—Philharmonic Auditorium
- 2:00- 4:00 Television Surgical Specialties—Foyer Biltmore Bowl
- 2:00- 4:00 Surgical Film Exhibition (E.E.N.T.)—Conference Room No. 1
- 2:00- 5:00 Hospital Standardization Conference—Music Room

- 2:00-5:00 Symposium on Cancer Clinics and Cancer Detection Centers—Ballroom  
 3:00-5:00 Symposium on Fractures and other Traumas—Biltmore Theater  
 3:30-5:00 Panel Discussion—Philharmonic Auditorium  
 7:00-8:00 Surgical Film Exhibition (E.E.N.T.)—Conference Room No. 5  
 8:00-9:30 Hospital Conference—Music Room  
 8:00-9:30 Scientific Session—General Surgery—Philharmonic Auditorium  
 8:00-9:30 Scientific Session—Ophthalmology—Conference Room No. 5  
 8:00-9:00 Scientific Session—Otorhinolaryngology—Conference Room No. 5

### Wednesday October 2

- 8:00-9:00 Meeting of Cancer Committee—Conference Room No. 6  
 8:00-9:00 Clinics and Demonstrations—Local Hospitals  
 8:30-9:00 Forum on Fundamental Surgical Problems—Ballroom  
 8:30-9:30 Forum on Fundamental Surgical Problems—Philharmonic Auditorium  
 9:00-9:30 Panel Discussion—Ophthalmology—Conference Room No. 5  
 9:00-9:00 State and Provincial Executive Committees—Engineers' Club  
 9:30-9:30 Hospital Conference—Music Room  
 9:30-9:30 Surgical Film Exhibition (General)—Biltmore Theater  
 9:00-9:00 Television, General Surgery—Foyer Biltmore Bowl (Lower Level)  
 10:00-10:00 State and Provincial Credentials Committees and Committees on Applicants and Judiciary Committees  
 4:45-5:00 Panel Discussion—Otorhinolaryngology—Conference Room No. 5  
 1:00-1:00 Luncheon—Meeting of Board of Governors  
 1:30-3:00 Panel Discussion—Philharmonic Auditorium  
 3:00-4:00 Surgical Film Exhibition (E.E.N.T.)—Conference Room No. 5  
 3:00-4:00 Television—Surgical Specialties—Foyer Biltmore Bowl (Lower Level)  
 3:00-5:00 Surgical Film Exhibition (General)—Biltmore Theater  
 3:00-5:00 Hospital Conference—Music Room  
 3:30-5:00 Panel Discussion—Philharmonic Auditorium  
 3:30-5:00 Meeting of National and Regional Fracture Committees—Ballroom  
 7:00-8:00 Surgical Film Exhibition (E.E.N.T.)—Conference Room No. 5  
 8:00-9:00 Combined Session—Ophthalmology and Otorhinolaryngology—Conference Room No. 5  
 8:00-9:30 Scientific Session—General Surgery—Philharmonic Auditorium  
 8:00-9:30 Hospital Conference—Music Room

### Thursday October 3

- 8:00-9:00 Clinics and Demonstrations—Local Hospitals  
 8:30-9:30 Forum on Fundamental Surgical Problems—Ballroom

- 8:30-9:30 Forum on Fundamental Surgical Problems—Philharmonic Auditorium  
 9:00-9:30 Panel Discussion—Ophthalmology—Conference Room No. 5  
 9:30-10:00 Hospital Conference—Music Room  
 9:00-10:00 Television, General Surgery—Foyer Biltmore Bowl  
 9:45-10:00 Panel Discussion—Otorhinolaryngology—Conference Room No. 5  
 10:00-10:45 Adjourned Meeting, Governors—Ballroom  
 1:45-3:00 Annual Meeting—Fellowship—Ballroom  
 2:00-4:00 Television, Surgical Specialties—Foyer Biltmore Bowl  
 3:00-5:00 Hospital Conference—Music Room  
 3:00-5:00 Surgical Film Exhibition (General)—Biltmore Theater  
 3:00-5:00 Symposium, Graduate Training in Surgery—Ballroom  
 3:30-5:00 Panel Discussion—Philharmonic Auditorium  
 3:00-4:00 Committee on The Library—Conference Room No. 6  
 6:00-8:00 Dinner for Committee on Fractures and Other Traumas and Chairmen, Regional Committees—Engineers' Club  
 7:00-8:00 Surgical Film Exhibition (E.E.N.T.)—Conference Room No. 5  
 8:00-9:00 Hospital Conference—Music Room  
 8:00-9:30 Scientific Session—General Surgery—Philharmonic Auditorium  
 8:00-9:30 Scientific Session—Ophthalmology—Conference Room No. 5  
 8:00-9:30 Scientific Session—Otorhinolaryngology—Conference Room No. 5

### Friday October 22

- 8:00-9:00 Clinics and Demonstrations—Local Hospitals  
 8:30-9:30 Forum on Fundamental Surgical Problems—Ballroom  
 8:30-9:30 Forum on Fundamental Surgical Problems—Philharmonic Auditorium  
 9:30-10:00 Surgical Film Exhibition (E.E.N.T.)—Biltmore Theater  
 9:00-10:00 Television—General Surgery—Foyer Biltmore Bowl  
 9:30-10:00 Surgical Film Exhibition (General)—Biltmore Theater  
 10:00-10:00 Assembly of Institutes—Temple, Baptist Church  
 10:00-4:30 Panel Discussions for each of the following: Gynecology and Obstetrics—Conference Room No. 5  
 Plastic Surgery—Ballroom  
 Neurological Surgery—Conference Room No. 5  
 Thoracic Surgery—Engineers' Club  
 Urology—Conference Room No. 9  
 Orthopedic Surgery—Biltmore Theater  
 12:00-4:00 Television—Surgical Specialties—Foyer Biltmore Bowl  
 1:00-9:00 Clinics and Demonstrations—Local Hospitals  
 7:30-8:00 Assembly of Institutes for Professional—Temple Baptist Church  
 8:30-9:00 Convocation—Philharmonic Auditorium

## PRELIMINARY CLINICAL PROGRAM

## PARTICIPATING HOSPITALS AND HOSPITAL CLINICS COMMITTEE

California Lutheran Hospital Los Angeles—William F Quinn, M.D.  
 Cedars of Lebanon Hospital, Los Angeles—Adolph A. Kutzmann M.D. F.A.C.S.  
 Children's Hospital, Los Angeles—J. Norton Nichols, M.D., F.A.C.S.  
 French Hospital Los Angeles—Pierre Paul Viole, M.D.  
 Glendale Sanitarium and Hospital, Glendale—Eugene J. Joergensen, M.D., F.A.C.S.  
 Hospital of the Good Samaritan Los Angeles—Francis M. McKeever M.D.  
 Collis P. and Howard Huntington Memorial Hospital, Pasadena—Leroy B. Sherry, M.D. F.A.C.S.  
 Los Angeles County General Hospital, Los Angeles—Clarence J. Berne, M.D., F.A.C.S.  
 Methodist Hospital of Southern California, Los Angeles—Paul A. Quaintance, M.D. F.A.C.S.  
 Orthopaedic Hospital, Los Angeles—Ward M. Rolland, M.D. F.A.C.S.  
 Physicians and Surgeons Hospital Glendale—John R. Paxton, M.D., F.A.C.S.  
 Presbyterian Hospital—Olmsted Memorial, Hollywood—William H. Snyder M.D. F.A.C.S.  
 Queen of Angels Hospital, Los Angeles—Donald E. Ross, M.D. F.A.C.S.

St. Francis Hospital, Lynwood—Finis G. Cooper M.D. F.A.C.S.  
 St. John's Hospital, Santa Monica—George Arnold Stevens, M.D. F.A.C.S.  
 St. Joseph Hospital, Burbank—Ralph H. Walker M.D., F.A.C.S.  
 St. Luke Hospital, Pasadena—James M. Marshall, M.D., F.A.C.S.  
 St. Vincent's Hospital Los Angeles—William P. Kroger M.D., F.A.C.S.  
 Santa Fe Coast Lines Hospital Los Angeles—Richard J. Flannan M.D. F.A.C.S.  
 Santa Monica Hospital Santa Monica—Leo J. Madsen, M.D. F.A.C.S.  
 U.S. Army McCormack General Hospital Pasadena—Colonel Lawrence C. Ball, M.C., U.S.A.  
 U.S. Naval Hospital, Long Beach—Captain F. C. Hill  
 U.S. Veterans Administration Birmingham General Hospital, Van Nuys—Joseph A. Weinberg, M.D.  
 U.S. Veterans Administration Center Wadsworth General Hospital Sausalito—Francis V. Byron M.D.  
 White Memorial Hospital, Los Angeles—Clarence E. Stafford M.D. F.A.C.S.

## CLINICS IN LOS ANGELES AND VICINITY HOSPITALS

CALIFORNIA LUTHERAN HOSPITAL  
LOS ANGELES

## Monday

8:00-12:00. *General Surgery* Operative Clinics  
 Gastrointestinal Surgery—Vagotomy and Gastroenterostomy JACK FARRIS and ASSOCIATES  
 Two Team Abdominal Perineal. MALCOLM HILL and ASSOCIATES.  
 Gastric Resections. WILLIAM F. QUINN NORMAN CARDEY

## Tuesday

8:00-12:00. *General Surgery* Operative Clinics  
 Carcinoma of Face, Neck, and Breast. Los Angeles Tumor Institute Staff.  
 Carcinoma of Stomach. L. A. ALESOV  
 Thoracic Surgery Operative Clinic  
 Carcinoma of Lung LYMAN BREWER and ASSOCIATES.

## Wednesday

8:00-12:00. *General Surgery* Operative Clinics  
 Lesions of Thyroid. O. DALE LLOYD  
 Cholecystic Disease W. H. OLDS and ASSOCIATES.  
 Hernioplasty F. LEIX and A. LAUBERHETMER.

## Thursday

8:00-12:00. *Obstetrics and Gynecology* Operative Clinics  
 Total Hysterectomy DONALD G. TOLLEFSON and ASSOCIATES.  
 Vaginal Hysterectomy PAULA HORN and ASSOCIATES.  
 Total Hysterectomy WILLIAM BROWNFIELD and ASSOCIATES.

Low Cervical Section and other Gynecological Procedures. RALPH THOMPSON GEORGE HEWITT and A. N. WEBB

CEDARS OF LEBANON HOSPITAL,  
LOS ANGELES

## Tuesday

10:00-12:00. *General Surgery* Operative Clinic Thyroidectomy M. KAHN M. BAY  
 10:00-12:00. *Gynecology* Operative Clinic Selected cases. E. KRAHULICK.  
 10:00-12:00. *Genitourinary Surgery* Operative Clinic Selected cases. J. STEINBERG

## Wednesday

10:00-12:00. *General Surgery* Operative Clinic Smithwick operation. M. RABWIN  
 10:00-12:00. *Vascular Surgery* Operative Clinic Selected cases. TRACY PUTNAM

## Thursday

10:00-12:00. *General Surgery* Operative Clinic Abdominal surgery I. J. OLCH  
 10:00-12:00. *Gynecology* Operative Clinic Selected cases. JOSEPH HARRIS, LEON KROHN  
 10:00-12:00. *Genitourinary Surgery* Operative Clinic Selected cases. J. STEINBERG.

## Friday

10:00-12:00. *General Surgery* Operative Clinic Selected cases. S. HENRIKOFF  
 10:00-12:00. *Thoracic Surgery* Operative Clinic Selected cases. A. GOLDMAN

## Tuesday through Friday

10:00-2:00. *General Surgery* Nonoperative Clinic. Smithwick Operation. Colectomy. Gall Bladder. Thyroid. Roentgenology. Pathology. M. RABKIN. D. ROSENBLUM, BLANK, BAY, L. V. OLICH, Members of Thyroid Committee, EDWARD T. FRYM, N. T. IRDMAN.

## CHILDREN'S HOSPITAL, LOS ANGELES

## Monday

*Thoracic Surgery* Operative Clinics. Blalock Operation.

Bronchoscopy.

*Oral Surgery* Operative Clinics.

Cleft Palate.

Cleft Lip.

*Orthopedic Surgery* Operative Clinics.

Hip Fusion.

Triple Arthrodesis.

Blow, Knee.

## Tuesday

*Otolaryngology* Operative Clinics. Tonsillectomy and Adenoidectomy and Mastoidectomy.

*Plastic Surgery* Operative Clinics. Padgett Crafts, Reconstruction Larynx, and Excision of Nevi with Graft.

*Ophthalmology* Operative Clinics. Recession and Resection. Tuck and Recession. O'Connor. Clinch, Moses. Muti.

## Wednesday

*General Surgery* Operative Clinics.

Herniorrhaphy.

Orchiopexy.

Appendectomy.

Thyroidectomy.

*Thoracic Surgery* Operative Clinics.

Coarctation.

Patent Ductus.

## Thursday

*Genitourinary Surgery* Operative Clinics.

Nephrectomy.

Bladder Neck Resection.

Cystoscopy.

*Orthopedic Surgery* Operative Clinics.

Spinal Fusion.

Arthrodesis (Britton type).

*General Surgery* Operative Clinics.

Rectovaginal Fistula.

*Thoracic Surgery* Operative Clinics.

Bronchoscopy.

Laryngoscopy.

*Neurosurgery* Operative Clinics.

Cerebellar Excision.

Choroid Plexectomy.

Bone Flap.

## Friday

*Otolaryngology* Operative Clinics.

Tonsillectomy and Adenoidectomy.

*General Surgery* Operative Clinics.

Pyloroplasty.

Herniorrhaphy.

*Ophthalmology* Operative Clinics.

Recession and Resection.

Enucleation.

Ptosis.

## FRENCH HOSPITAL, LOS ANGELES

## Wednesday

10:30-12:30. *Tumor Surgery* Nonoperative Clinic. Radical Cancer Surgery of Head and Neck—slides—cases. SAM PERLICK.

12:30-2:30. *Tumor Surgery* Nonoperative Clinic. Continued Attack of Cancer of Head and Neck—slides—cases. CLYDE EMERY.

2:30-4:30. *Tumor Surgery* Nonoperative Clinic. Benign Tumors of Neck—slides. ALONSO POLLAK.

4:30-6:30. *General Surgery* Nonoperative Clinic. Removal of Thyroidal Duct Cyst—motion pictures. LINDER B. LL.

## Wednesday Afternoon

Round Table Discussion. ARTHUR J. MEYERHALL, FRED G. SPARD, IVO LOMBECK, VICTOR CERRILL, PIERRE VIOLE.

## HOSPITAL OF THE GOOD SAMARITAN, LOS ANGELES

## Tuesday

8:00-10:00. *General Surgery* Operative Clinics: Selected Cases. LA. R. VICK CHAFFIN, WILLIAM NOBLE.

10:00-12:00. *Thoracic Surgery* Operative Clinics: Selected Cases. J. W. C. JONES.

12:00-2:00. *Neurosurgery* Operative Clinics: Selected Cases. GEORGE P. TIERNEY.

## Wednesday

8:00-10:00. *General Surgery* Operative Clinics: Selected Cases. PHILIP J. CONNOR.

10:00-12:00. *Genitourinary Surgery*, Operative Clinics: Selected Cases. KENNETH SMILEY.

12:00-2:00. *Neurosurgery* Operative Clinics: Selected Cases. CARL W. RAY.

2:00-4:00. *Ophthalmology* Operative Clinics: Selected Cases. GEORGE P. LINDBERG.

## Thursday

8:00-10:00. *General Surgery* Operative Clinics: Selected Cases. C. J. BERRY, J. N. NICHOLS, KENNETH BLAIR.

10:00-12:00. *Thoracic Surgery* Operative Clinics: Selected Cases. F. A. S. DOLLEY.

*Otolaryngology* Operative Clinics: Selected Cases. I. SHUMAKER.

## Friday

8:00-10:00. *General Surgery* Operative Clinics: Selected Cases. L. WRENCH CHAFFIN.

10:00-12:00. *Genitourinary Surgery*, Operative Clinics: Selected Cases. W. J. JONES.

12:00-2:00. *Gynecology* Operative Clinics: Selected Cases. H. SHAW.

2:00-4:00. *Orthopedic Surgery* Operative Clinics: Selected Cases. JERRY WILSON.

## COLLIS P. AND HOWARD HUNTINGTON MEMORIAL HOSPITAL, PASADENA

*Tumor Surgery* Operative Clinics. Selected Cases. GEORGE S. SMAR, E. W. DICKER.

*Plastic Surgery* Operative Clinics. Correction of Burn Contractures. G. V. WENSTER.

*Gas Therapy* Operative Clinics. Application of Intermittent Positive Pressure Breathing for Control of Respiratory Depression. JOHN B. DILLON.

- Orthopedic Surgery** Operative Clinic  
Early Recognition and Treatment of Congenital Hips  
E. D. RISSEK
- General Surgery** Operative Clinic  
Abdominal Surgery in the Aged and Portacaval Anastomoses in Cirrhosis of the Liver ARTHUR C. PATTISON
- Pathology** Nonoperative Clinic  
Tumors and Cysts of the Ovary—A Pathologic Demonstration A. G. FOORD
- General Surgery** Nonoperative Clinic  
The Cardiac Risk in Surgery GEORGE GRIFFITH
- Tumor Surgery** Nonoperative Clinic  
Tumor Clinic Demonstration—Selected Cases to Show the Operation of a Diagnostic Tumor Clinic in a Voluntary Hospital. E. D. KREMKER and STAFF

LOS ANGELES COUNTY GENERAL  
HOSPITAL, LOS ANGELES

Monday

- 2:00-4:00 **Orthopedic Surgery** Nonoperative Clinic  
Fractures. VERNON THOMPSON and ASSOCIATES, G. MOSSER TAYLOR and ASSOCIATES

Tuesday

- 8:00-12:00 **Genitourinary Surgery** Operative Clinic  
Selected Cases. ROGER W. BARNES, ADOLPH A. KUTZ, MAURICE TRACEY O. POWELL
- 8:00-12:00 **Thoracic Surgery** Operative Clinic  
Selected Cases. FRANK S. DOLLEY, LYMAN A. BREWER
- 8:00-12:00 **Tumor Surgery** Operative Clinic  
Head and Neck. IAN MACDONALD, S. L. PERZIK, LEWIS W. GUIES
- 8:00-12:00 **General Surgery** Operative Clinics  
Surgery of the Neck. C. J. BAUMGARTNER and OTHERS  
Portacaval Shunt. ARTHUR C. PATTISON and OTHERS.
- 2:00-4:00 **General Surgery** Nonoperative Clinic  
Thyroid Symposium. C. J. BAUMGARTNER, Moderator

Wednesday

- 8:00-12:00 **Obstetrics and Gynecology** Operative Clinics  
Selected Cases. W. C. BRADBURY, CARL E. KRUGMEIER, HENRY N. SHAW, HAROLD K. MARSHALL and OTHERS.
- 8:00-12:00 **General Surgery** Operative Clinics  
Selected Cases. MALCOLM HILL, PAUL C. BLAISDELL  
Abdominal-Gastrointestinal. E. ERIC LARSON and OTHERS.
- Surgery of Lower Esophagus, Cardia, and Stomach.  
HAROLD L. THOMPSON, E. J. JOERGENSEN, HARRY C. PROUT.
- 2:00-4:00 **General Surgery** Nonoperative Clinic  
Esophageal and Gastric Symposium. HAROLD L. THOMPSON, Moderator

Thursday

- 8:00-12:00 **Orthopedic Surgery** Operative Clinic  
Selected Cases. G. MOSSER TAYLOR, JOSEPH C. RISSER
- 8:00-12:00 **Genitourinary Surgery** Operative Clinic  
Selected Cases. J. J. CRANE, DONALD A. CHARNOCK, CARL F. RUSCHIE
- 8:00-12:00 **Thoracic Surgery** Operative Clinic  
Selected Cases. JOHN C. JONES and ASSOCIATES.
- 8:00-12:00 **General Surgery** Operative Clinics  
Selected Cases. C. J. BERNIE and OTHERS.  
Selected Cases. LAWRENCE CHAFFIN, PHILIP J. CUNNANE and OTHERS.
- 2:00-4:00 **Tumor Surgery** Nonoperative Clinic  
Malignancy Symposium. IAN MACDONALD.

Friday

- 8:00-12:00 **General Surgery** Operative Clinics  
Selected Cases. W. H. DANIEL, ROBERT L. BELT  
Hernia. GORDON K. SMITH, L. C. BAILL
- Pediatric Surgery. J. NORTON NICHOOLS and OTHERS.
- 8:00-12:00 **Orthopedic Surgery** Operative Clinic.  
Selected Cases. VERNON P. THOMPSON, FRANCIS M. McKEEVER, PAUL F. McMASTER.
- 8:00-12:00 **Tumor Surgery** Operative Clinic.  
Neck Dissection and Radical Mastectomy. JUSTIN STEIN, E. J. JOERGENSEN, C. E. NELSON
- 2:00-4:00 **General Surgery** Nonoperative Clinic  
Problem of Fluid and Electrolytic Balance in Surgery.  
C. J. BERNIE, Moderator

METHODIST HOSPITAL OF  
SOUTHERN CALIFORNIA, LOS ANGELES

Monday

- 8:00-12:00 **Thoracic Surgery** Operative Clinic  
Selected Cases. LYMAN A. BREWER, FRANK S. DOLLEY
- 8:00-12:00 **Tumor Surgery** Operative Clinic. Selected Cases. CLYDE EMERY TUMOR GROUP, SAMUEL L. PERZIK
- 8:00-12:00 **Orthopedic Surgery** Operative Clinic. Selected Cases. HAROLD E. CROWE, KENNETH TOWNSEND
- 8:00-12:00 **Ophthalmology and Otolaryngology** Operative Clinic. Selected Cases. WALTER R. CRANE.

Friday

- 8:00-12:00 **Genitourinary Surgery** Operative Clinic  
Selected Cases. F. A. BENNETTS, CARL L. MULFINGER
- 8:00-12:00 **Obstetrics and Gynecology** Operative Clinic  
Selected Cases. A. A. BLATHERWICK, CARL E. KRUGMEIER, ELDON W. TICE.
- 8:00-12:00 **General Surgery** Operative Clinic. Selected Cases. CALIFORD O. BISHOP, G. R. DUNLEVY, LEWIS F. ELLMORE, ADOLPH M. HANSEN, E. A. NELSON, ROY F. SHIPLEY, JOSEPH A. PARKER, HAROLD P. TOTTEIN
- 8:00-12:00 **Hand Surgery** Operative Clinic  
Selected Cases. JOSEPH H. BOYER.

ORTHOPEAEDIC HOSPITAL, LOS ANGELES

Monday

- 8:00-11:00 **Orthopedic Surgery** Operative Clinic. Spinal Fusion for Scoliosis. JOSEPH RISSER.

Wednesday

- 8:00-10:00 **Orthopedic Surgery** Operative Clinic. Fascial Transplants. CHARLES LOWMAN

Thursday Morning

- 10:00-12:00 **Orthopedic Surgery** Nonoperative Clinic  
Surgical Conference. HAROLD CROWE.

Every Afternoon

- Orthopedic Surgery** Nonoperative Clinic.

PHYSICIANS AND SURGEONS HOSPITAL,  
GLENDALE

Days not yet decided

- 8:30-12:00 **Gynecology** Operative Clinic. Vaginal Plastic Procedures. H. K. MARSHALL.
- 8:30-12:00 **General Surgery** Operative Clinic. Two-Team Abdominoperineal Reaction of Rectum. R. E. BELT
- 8:30-12:00 **General Surgery** Operative Clinic. Resection Carcinoma of Esophagus or Transthoracic Vagotomy. H. L. THOMPSON



- Orthopedic Surgery* Nonoperative Clinic  
Knee Surgery. HENRY JOYCE.
- Orthopedic Surgery* Nonoperative Clinic  
Surgical Treatment of Fractures—motion pictures.  
CHARLES GILFILLAN.
- Orthopedic Surgery* Nonoperative Clinic  
Internal Fixation of Fractures. JOSEPH WOOL.
- Orthopedic Surgery* Nonoperative Clinic  
Backache. JOSEPH BLACK.
- Gynecology* Nonoperative Clinic  
General Vaginal Prolapse. H. K. MARSHALL, DUNSMO  
TARR, MARY STUBBSANT.

PRESBYTERIAN HOSPITAL—OLMISTED  
MEMORIAL, HOLLYWOOD

Tuesday

- Tumor Surgery* Operative Clinics  
8:00-9:00. Carcinoma of the Breast. TUMOR BOARD.  
9:00-10:00. Carcinoma of the Cervix. TUMOR BOARD.  
10:00-11:00. *Tumor Surgery* Nonoperative Clinic TUMOR  
BOARD.

Wednesday

- 8:00-10:00. *Genitourinary Surgery* Operative Clinic  
Selected Cases. STAFF.
- 8:00-10:00. *General Surgery* Operative Clinics  
Thyroidectomy. STAFF.  
Gastric Resection. STAFF.  
Lobectomy. STAFF.
- 10:00-11:00. *Genitourinary Surgery* Nonoperative Clinic  
Surgical Treatment for Genital Rejuvenation Including  
Urinary Incontinence. With Exhibit. ARNOLD KROSSL.
- 10:00-11:00. *General Surgery* Nonoperative Clinic  
Traumatic Injuries to Abdomen. DOUGLAS COLLINGS.

Thursday

- 8:00-10:00. *General Surgery* Operative Clinic  
Selected Cases. STAFF.
- 9:00-10:00. *Plastic Surgery* Operative Clinic  
Mastopexy. OTTO BAWER.
- 10:00-11:00. *Plastic Surgery* Nonoperative Clinic  
Demonstration Plastic Technique. OTTO BAWER.

QUEEN OF ANGELS HOSPITAL, LOS ANGELES

Friday

- 9:00-10:00. *Obstetrics and Gynecology* Operative Clinics.  
Total Hysterectomy. I. F. SCHUBER.  
Vaginal Hysterectomy. SAMUEL MATTING.  
Vaginal Plastic Operation for Correction of Cystocele  
Rectocele and Laceration of Pelvic Floor. H. NIX  
BERGALL.
- Vaginal Plastic Operation for Correction of Stress In-  
continence of Urine (Kennedy Procedure). D. R.  
MISHELL.
- 11:30-12:00. *Obstetrics and Gynecology* Nonoperative  
Clinics.  
Pregnancy Following Conservative Treatment for Pelvic  
Endometriosis. U. E. ABE.
- Endometrial Carcinoma: Survey of Eleven Years at  
Queen of Angels. R. F. KELLY.
- Early Rupture of the Uterus Before the Onset of Labor.  
C. V. VON DER ABE.
- Low Spinal Anesthesia in Obstetrics. A report of 1,000  
cases. W. G. CALDWELL.

Saturday

- 9:00-10:00. *Otorhinolaryngology and Ophthalmology* Oper-  
ative Clinics.

- Penetration Operation. H. P. HOGAN.
- Neoplastic Operation. J. GAYMON.
- Parotid Tumor Exposing Facial Nerves and Saving  
Trunk and Branches. D. E. ROSS.
- Cataract. Wm. H. BOYD and LYNN SERRAVALLO.
- 1:30-2:00. *Otorhinolaryngology and Ophthalmology* Non-  
operative Clinics.
- Illustrated Lectures: Acute Obstructive Laryngitis. A. H.  
MILLER; Treatment of Corneal Opacities by Radiation  
Therapy. Wm. H. BOYD.
- Motion Picture and Lecture: Technique of Tracheal  
Intubation. LYNN SERRAVALLO.
- The Sclerotic Mastoid and Its Roentgen Interpretation.  
GILBERT R. OWEN.
- Deafness in Children Treated by Radiation. L. E.  
GORDON.
- Parotid Tumor Exposing Facial Nerves and Saving  
Trunk and Branches. D. E. ROSS.

Sunday

- 9:00-10:00. *Orthopedic Surgery* Operative Clinics:  
Intermedullary Fixing of Fracture of the Femur. A. E.  
GALLAGHER.
- Osteotomy and Fixation of Non-Union of Neck of the  
Femur by New Reverse Nail. GALE HUNT.
- Symphyllectomy for Peripheral Vascular Disease. E. B.  
PLUMPTRE.
- Laminectomy for Herniated Intervertebral Disc, followed  
by Spinal Fusion. CHRISTOPHER MARON.
- 1:30-2:00. *Orthopedic Surgery* Nonoperative Clinics:  
Spinal Fusion in Relation to Herniated Disc Operation.  
E. B. PLUMPTRE.
- Slipped Upper Femoral Epiphysis. GALE HUNT.
- Reconstruction of Elbow Injuries. HOMER PERRAULT.

ST JOHN'S HOSPITAL, SANTA MONICA

Monday

- 8:00-10:00. *General Surgery* Operative Clinic: Surgery of  
the Gallbladder. R. M. NEALE.
- 8:00-10:00. *Obstetrics and Gynecology* Operative Clinic:  
Cesarean Section (McCombs Uterus). B. H. W. THOMAS.
- 10:00-11:00. *General Surgery* Operative Clinic: Surgery  
of the Colon. G. A. STEVENSON.
- 1:00-2:00. *Orthopedic Surgery* Operative Clinic: Lame-  
nectomy with Spinal Fusion. D. H. LEVINTHAL.

Tuesday

- 8:00-10:00. *General Surgery* Operative Clinic: Thyroid-  
ectomy. G. A. STEVENSON.
- 8:00-10:00. *Obstetrics and Gynecology* Operative Clinic:  
Anterior and Posterior Colpoproctopexy and Kelly  
Sitch. JAMES C. DOYLE and A. C. MILLER.
- 10:00-12:00. *General Surgery* Operative Clinic: Gastric  
Resection. M. RABINOWITZ and D. H. ROSENBLUM.
- 1:00-2:00. *Orthopedic Surgery* Operative Clinic: Ar-  
throplasty of the Knee. D. H. LEVINTHAL.

Wednesday

- 8:00-10:00. *General Surgery* Operative Clinic: Radical  
Mastectomy. J. F. ROBERTS.
- 8:00-10:00. *Genitourinary Surgery* Operative Clinic:  
Retro-pubic Prostatectomy. G. J. THOMAS and F. C.  
SCHEIDENBERGER.
- 10:00-11:00. *General Surgery* Operative Clinic: Vagotomy  
and Posterior Gastroenterostomy. F. E. BROWNE and  
HENRY J. LANGE.
- 1:00-2:00. *Plastic Surgery* Operative Clinic: Rhino-  
plasty. J. J. PRAEMER.

## Thursday

- 8:00-10:00. *General Surgery* Operative Clinic Herniorrhaphy (Tantalum Gauze and Tantalum Wire) M. RABWIN and D. H. ROSENBLUM
- 8:00-10:00. *Obstetrics and Gynecology* Operative Clinic Total Hysterectomy B. H. WATSON
- 10:00-12:00. *General Surgery* Operative Clinic McVay Herniorrhaphy F. E. BROWN and HENRY J. LANGE.
- 10:00-12:00. *General Surgery* Operative Clinic Exploration of Common Duct. G. A. STEVENS.
- Daily Pathological, nonoperative clinic, Rapid Method of Surgical Tissue Diagnosis. G. H. HUMMER.
- Daily Micro. Laboratory nonoperative clinic, Photographic Aids. G. H. HUMMER.

## ST JOSEPH HOSPITAL, BURBANK

Days not yet decided

- General Surgery* Operative Clinic Selected cases.

## ST LUKE HOSPITAL, PASADENA

Day not yet decided

- Orthopedic Surgery* Nonoperative Clinic
- Genitourinary Surgery* Nonoperative Clinic

## ST VINCENT'S HOSPITAL, LOS ANGELES

## Tuesday

- 9:00-10:00. *Otolaryngology* Operative Clinic Selected cases. J. MACKENZIE BROWN
- 9:00-10:00. *Ophthalmology* Operative Clinic Selected cases. A. RAY IRVINE.
- 9:00-11:00. *General Surgery* Operative Clinic Thyroidectomy Wm. P. KROGER.
- 9:00-11:00. *General Surgery* Operative Clinic Selected cases. FRANK J. BRESLIN
- 9:00-12:00. *General Surgery* Operative Clinic Selected cases. F. E. BROWN HENRY J. LANGE.
- 9:00-12:00. *Tumor Surgery* Operative Clinic Selected cases. IAN MAC DONALD LEWIS W. GUTS.
- 10:00-  
10:30-  
11:00-  
11:00-12:00. *Tumor Surgery* Nonoperative Clinic Malignant Lesions of Colon. K. S. DAVIS
- 10:30-  
11:00-  
11:00-12:00. *General Surgery* Nonoperative Clinic Surgery of Colon—motion pictures W. H. DANIEL.
- 11:00-  
11:00-12:00. *General Surgery* Nonoperative Clinic Surgery of Esophagus—motion picture. H. LINDCOLN THOMPSON
- 11:00-12:00. *General Surgery* Operative Clinic Selected cases. CONRAD J. BAUMGARTNER.
- 11:00-12:00. *General Surgery* Operative Clinic Colon Surgery RALPH V. BYRNE.

## Wednesday

- 9:00-12:00. *Orthopedic Surgery* Operative Clinic Selected cases. HUGH T. JONES, JOHN R. BLACK.
- 9:00-12:00. *Orthopedic Surgery* Operative Clinic Selected cases. FRANCIS M. McKEEVER.
- 9:00-12:00. *Neurosurgery* Operative Clinic Selected cases. RUPERT B. RANNEY
- 9:00-12:00. *Neurosurgery* Operative Clinic Selected cases. C. HUNTER SHULDEN
- 9:00-12:00. *Otolaryngology* Operative Clinic Fenestration. HOWARD P. HOUSE.
- 9:00-12:00. *Ophthalmology* Operative Clinic Selected cases. JOHN P. LORAN
- 9:00-12:00. *Plastic Surgery* Operative Clinic Selected cases. ARTHUR E. SMITH.

- 10:00-  
10:30-  
11:00-  
11:00-12:00. *Tumor Surgery* Nonoperative Clinic Thyroid Malignancy HENRY J. LANGE.
- 10:30-  
11:00-  
11:00-12:00. *Tumor Surgery* Nonoperative Clinic Struma Lymphomatosa and Fibrosis. ROBERT C. SURRIDGE.
- 11:00-  
11:00-12:00. *General Surgery* Nonoperative Clinic Obstructive Corrosive Gastritis. LOUIS C. BENNETT

## Thursday

- 9:00-11:00. *General Surgery* Operative Clinic Selected cases. E. VINCENT ARKEY
- 9:00-  
9:00-12:00. *Otolaryngology* Operative Clinic Selected cases. JOSEPH B. STEVENS.
- 9:00-12:00. *Gynecology* Operative Clinic Selected cases. BERNARD J. HANLEY JOHN C. McDERMOTT
- 9:00-12:00. *Proctology* Operative Clinic Surgery of Colon WILLIAM H. DANIEL.
- 9:00-12:00. *General Surgery* Operative Clinic Vagus Neurectomy EDWARD C. PALLETTE.
- 9:00-12:00. *Ophthalmology* Operative Clinic Selected cases. CLARENCE H. ALRAUGH.
- 10:00-  
10:30-  
11:00-  
11:00-12:00. *Orthopedic Surgery* Nonoperative Clinic Surgery of Hand. FRANK J. BRESLIN
- 10:30-  
11:00-  
11:00-12:00. *Orthopedic Surgery* Nonoperative Clinic Surgery of Knee Joint. HUGH T. JONES, JOHN R. BLACK.
- 11:00-  
11:00-12:00. *Neurosurgery* Nonoperative Clinic Surgical Management of Intracranial Aneurysms—motion picture and lantern slide illustrations.
- 11:00-12:00. *General Surgery* Operative Clinic Selected cases. E. ERIC LARSON

## Friday

- 9:00-11:00. *General Surgery* Operative Clinic Selected cases. LOUIS C. BENNETT
- 9:00-11:00. *Plastic Surgery* Operative Clinic Selected cases. ARTHUR E. SMITH.
- 9:00-12:00. *General Surgery* Operative Clinic Selected cases. FRANCIS E. BROWN HENRY J. LANGE.
- 9:00-12:00. *General Surgery* Operative Clinic Selected cases. Wm. P. KROGER, ROBERT C. SURRIDGE.
- 9:00-12:00. *Genitourinary Surgery* Operative Clinic Selected cases. A. J. SCHOLL, E. CROWLEY
- 10:00-  
10:30-  
11:00-  
11:00-12:00. *General Surgery* Nonoperative Clinic Thoracic Vagus Neurectomy—motion picture EDWARD C. PALLETTE.
- 10:30-  
11:00-  
11:00-12:00. *General Surgery* Nonoperative Clinic Surgery of Spleen. RALPH V. BYRNE.
- 11:00-  
11:00-12:00. *General Surgery* Nonoperative Clinic Carcinoma of Tongue, or Primary Mandibular Tumors. IAN MACDONALD LEWIS GUTS.
- 11:00-12:00. *General Surgery* Operative Clinic Selected cases. DAVID A. SCHMIDT

SANTA FE COAST LINES HOSPITAL,  
LOS ANGELES

## Monday

- 9:00-11:00. *Genitourinary Surgery* Operative Clinic Retropubic Prostatectomy V. J. GALLAGHER.
- 9:00-10:00. *Neurosurgery* Nonoperative Clinic The Herniated Intervertebral Disc Discussion of Multiple Herniations. HENRY M. CUNEO
- 9:00-10:00. *Otolaryngology* Nonoperative Clinic Allergy of the Nose and Paranasal Sinuses. GORDON J. MCCURDY

## THE SANTA MONICA HOSPITAL

## Thursday

- 9:00-11:00. *General Surgery* Nonoperative Clinics

Traumatic Surgery C. A. LINDBQVIST  
A New Method for the Movement of Fluids in the Extremities J. P. SAMPSON and FREDERICK G. KIRBY  
*Orthopedic Surgery* Operative Clinics:  
Reconstructive Orthoplasty of Congenitally Dislocated Hip WILLIAM H. WRIGHT  
Demonstration Pre-ambulatory Diagram of Dislocated Hips JOSEPH RUSSELL  
Contrast Orthogram of Dislocated Hips. RALPH MILLER

# U. S. ARMY MCCORNICK GENERAL HOSPITAL, PASADENA

## Friday

9:00-9:30. *Genitourinary Surgery* Nonoperative Clinic  
Amicrobic Urinary Infections LYMAN STEWART  
9:30-10:00. *General Surgery* Nonoperative Clinic  
The Treatment of Regional Ileitis. GORDON K. SMITH  
10:00-10:30. *Plastic Surgery* Nonoperative Clinic  
Treatment of Facial Injuries. MORRIS K. RYCE  
10:30-11:00. *Orthopedic Surgery* Nonoperative Clinic  
Treatment of Fracture of Forearm. VERNON LOCK  
11:00-11:30. *General Surgery* Nonoperative Clinic Hernia  
Repair Using Cooper Ligament LAWRENCE C. BELL

# U. S. NAVAL HOSPITAL, LONG BEACH

## Tuesday

9:00-10:00. *General Surgery* Operative Clinics Gastroenterology E. F. LARSON Cholecystectomy L. L. BRYAN  
*Genitourinary Surgery* Operative Clinics:  
Retro Public Prostatectomy CARL RUSSELL  
Varicocelectomy MILLO ELLIK and L. A. NEWTON  
*Orthopedic Surgery* Operative Clinic:  
Operation for Recurrent Dislocation of the Shoulder R. R. MYERS and JOHN M. ROWE  
*Otolaryngology* Operative Clinic Rhinoplasty Using Cancellous Bone E. KING, R. C. BOYDEN, F. L. ASKLEV  
*Vascular Surgery* Nonoperative Clinic Cerebral Aneurysm. ROBERT PUDENZ, CHAS. H. SHELTON, A. L. SCHULTZ  
*Thoracic Surgery* Nonoperative Clinic Carcinoma of the Lung BERT H. COTTON and M. L. GIERBER  
10:00-11:00. *General Surgery* Nonoperative Clinics Ward Rounds, Follow-up on Vagus Resection and Gastric Resection E. E. LARSON RALPH BYRDE, W. L. DELPITY CALVIN LAUER, L. L. BEAN  
*Genitourinary Surgery* Nonoperative Clinic  
Post-operative Results from high V. ricocelectomy CARL RUSSELL, MILLO ELLIK, and L. A. NEWTON  
11:00-12:00. *Otolaryngology* Nonoperative Clinic Motion Pictures Nasal Bone Graft and Post-operative Results E. KING, R. C. BOYDEN, K. C. BRANDENBURG  
12:00-1:00. *Neurosurgery* Operative Clinic  
Trans-frontal Craniotomy or Cervical Disc. C. H. SHELTON, ROBERT PUDENZ, and A. L. SCHULTZ  
1:00-2:00. *Thoracic Surgery* Operative Clinic  
Pneumectomy BERT COTTON and M. L. GIERBER  
2:00-4:00. *Orthopedic Surgery* Nonoperative Clinic  
Ward Rounds, Post Operative Care of the Orthopedic Patient JOHN M. ROWE and R. R. MYERS, J. G. BLAXNED

# U. S. VETERANS ADMINISTRATION BIRMINGHAM GENERAL HOSPITAL, VAN NUYS

## Wednesday

9:00-10:00. *Genitourinary Surgery* Nonoperative Clinics

Results of Uretero-intestinal Implantation and Cystectomy for Carcinoma of Bladder D. C. MALCOLM  
*Thoracic Surgery* Operative Clinics:  
Pulmonary Decortication JOSEPH A. WATKINS  
*General Surgery* Operative Clinics  
Surgical Problems of the Paraplegic. ERNEST BOES  
Trans-Abdominal V.otomy and Gastro J. junctionomy FRANKLIN B. WILKINS  
Thoracolumbar Sympathectomy by Intercostal Approach. THEODORE B. MARSHALL  
*Neurosurgery* Operative Clinic Cervical Laminectomy for Myelographic Disease JOHN D. FREYER  
*Otolaryngology* Operative Clinics. Reconstructive Rhinoplasty for Nasal Obstruction. SAMUEL KAPLAN  
Endaural Radical Mastoidectomy SAMUEL KAPLAN  
10:00-11:00. *Orthopedic Surgery* Nonoperative Clinics  
Care of Traumatic Injuries to the Hand. JOHN ALDER and J. BOYCE  
Treatment of Bone and Joint T.B. Rik Streptococcus JOHN ALDER

# U. S. VETERANS ADMINISTRATION CENTER, WADSWORTH GENERAL HOSPITAL, SAWTELLE

9:00-10:00. *General Surgery* Nonoperative Clinics  
Symposium Tri-ethylammonium in the Location of Peripheral Vascular Disease C. H. McBERTRE  
Results of Histidine and Ascorbic Acid Treatment of Peripheral Vascular Disease ROBERT WILKINSON and M. LEO RYKOWSKI  
A New Method for the Movement of Fluids in the Extremities J. G. KIRBY and J. P. SAMPSON (Santa Monica Hospital)  
*Orthopedic Surgery* Nonoperative Clinic  
Symposium Amputations in Peripheral Vascular Disease. ROBERT MAZET  
*General Surgery* Operative Clinic  
Laparic Sympathectomy CHARLES KIRBY  
11:00-12:00. *Neurosurgery* Operative Clinic C. F. McCORMICK  
E. KING, WATKINS, and NEYTH RUFF  
*Ophthalmology and Otolaryngology* Nonoperative  
10:00-9:30. Fundus Lesions with Pathological Sections and Microphotographic Slides. A. RAY FRYRE and C. S. MUNDA  
9:30-10:00. Malignancies (Ear Nose & Throat) 11th Case Presentations. C. S. MUNDA and STAFF  
10:00-11:00. Penetration Operation for Otosclerosis 11th Case Presentations. C. S. MUNDA and STAFF

# WHITE MEMORIAL HOSPITAL, LOS ANGELES

## Tuesday

9:00-10:00. *Genitourinary Surgery* Operative Clinic  
Urologic Surgery—T.M. for Cases—Demonstrations. ROBERT W. BARNES  
10:00-11:00. *Obstetrics and Gynecology* Operative Clinics:  
Vaginal Hysterectomy Cesarean Section. RALPH J. THOMPSON  
9:00-10:00. *Orthopedic Surgery* Nonoperative Clinic  
Orthopedic Clinic Problem Cases. G. MORRIS TAYLOR

## Wednesday

9:00-10:00. *General Surgery* Operative Clinics  
Total Removal of Parotid Gland without Sacrificing Facial Nerve. CLARENCE E. NELSON  
Carcinoma of the Rectum (Two-team Abdominal Perineal Resection) MALCOLM R. HILL  
9:00-10:00. *Otolaryngology* Operative Clinics  
Rhinoplasty Penetration Endoscopic Clinic. BRYSON N. COLEMAN

August, 1948

**SURGERY**  
**GYNECOLOGY AND OBSTETRICS**  
*Supplement*

**INTERNATIONAL ABSTRACTS  
OF SURGERY**

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# INTERNATIONAL ABSTRACTS OF SURGERY

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## COLLECTIVE REVIEW

### THE EARLY TREATMENT, AND RESULTS THEREOF, OF INJURIES OF THE COLON AND RECTUM

With 70 Additional Cases

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THE average report of any large series of cases results largely from the study of records and histories. Rarely is there the added advantage of personal observation and intimate knowledge of each patient concerned. The recent war enabled us to utilize such an advantage. It is hoped that a report of this nature may be as revealing on the basis of the intimacy of contact with each patient, as a larger series assembled solely on the basis of records.

The essential part of this article is constituted by the ideas arising from the accumulated experiences of the Ninth Evacuation Hospital<sup>1</sup> to which more than 51,000 patients were admitted while the hospital was operating in North Africa, Sicily Italy southern France, and Germany. The 70 cases of injury to the large bowel which we are presenting in considerable detail represent all patients with such injuries admitted to our hospital without having undergone any previous surgical treatment. These patients were brought to our hospital while we followed the American advances from the shores of southern France into the heart of Bavaria. This 10 month period includes late 1944 and extends well into 1945.

In addition, the literature on wounds of the large intestine through 1945 (and some articles in English published in 1946 and 1947) was reviewed, most emphasis being placed on the period since

<sup>1</sup>The Roosevelt Hospital Unit of New York City

1916. The French German Russian Italian and Chinese literature was reviewed, but no contributions of importance were found in it. It was found that the important advances have come from the British and Americans and mostly the British. The significant ideas and data found in this survey are presented together with our own data and experiences. Because the early and late phases of treatment are so intimately related to each other and to the final result we have included a brief consideration of the late phase of treatment and of the results to clarify the problem as a whole. Only in this way can the early surgical treatment be intelligently carried out.

Patients who had penetrating wounds of the abdomen were partially screened from this hospital by the surgeons working in the field hospitals. This screening was rarely complete, and under ideal circumstances only those men in good condition were allowed to reach us. There were many occasions on which the casualties were so heavy that the field hospitals were unable to cope with all the men with serious abdominal wounds, and had to evacuate them to us untreated. Men in this group comprised a large proportion of our patients, and the added factor of time and a prolonged ride in an ambulance made the outcome less favorable. This is mentioned to point out the fact that the condition of some of these men was the same as that of desperately ill men whom one would expect to find in a field hospital.

All our patients with abdominal wounds were taken to the shock ward immediately where they received preferential treatment. The rate of admission varied considerably. On one occasion surgical abdominal exploration was carried out 8 times during a 31 hour period. For 7 of these patients some form of colostomy was performed for injury to the large bowel. In another period 11 men with extensive injuries to the bowel were treated during the course of 6 days. In contrast to this, weeks might elapse without the occasion for surgical care for a single man.

Evacuation of these patients never was accomplished before the eighth postoperative day except in rare instances at the demand of the tactical situation. Fortunately none of these few patients were considered to be in such critical condition that they were likely to be harmed by travel.

The evacuation system from one hospital to another within the theater made it almost impossible to obtain data on the ultimate outcome of our patients. Therefore the main purpose of this article is to present the early results of injuries to the large bowel in their relationship to the extent of damage and the treatment accorded. Conclusions will be drawn which are felt justified on the basis of the data presented.

The types of missile which caused these injuries were divided equally between shell fragments and bullets. There were no instances of injury by blast, and no injury was caused by sharp instruments such as knives or bayonets. The causation in 2 cases was blunt force to the abdominal wall sustained in an automobile accident. One of these 2 patients exhibited in addition extensive lacerations in the mesentery of the ileum with sufficient damage of the circulation to have caused gangrene of two loops of the small bowel.

The average soldier possessed accurate knowledge as to whether he had been hit by a shell fragment, bomb fragment, or a bullet. However one could not expect him to be so dependable in de-

scribing the type of shell which had exploded in his neighborhood. The fear and respect accorded the German 88 mm gun gave many soldiers the fantastic impression that it was being used against them individually. The unreliable information on this score made it useless to attempt any further classification of shell fragments for instance, fragments of mortar shells or grenades. There seemed to be very little difference from the point of view of prognosis, whether the causative agent was a shell fragment or a bullet. Each one could be as devastating as the other. Men with wounds caused by massive shell fragments evidently die early for only one man so injured was seen in this hospital. He had sustained extensive injuries and died shortly after operation. His abdominal injuries were confined to the small intestine, and for this reason a description of the pathologic situation is not contained in the present article.

A survey of all the penetrating abdominal wounds during the period under consideration has shown that roughly half of them caused damage to the large bowel. The damage varied from transection and extensive laceration to small punctate wounds, abrasions, and contusions of the wall of the gut.

#### DIAGNOSIS

Too much stress cannot be placed on the importance of diagnosis in the treatment of penetrating wounds of the abdomen. The advances made in abdominal surgery are considerable, but the postoperative mortality rate in this type of war injury still occupies the unenviable position of being the highest. One important factor in the reduction of this rate is shortening of the interval between injury and operation (Table I). The surgeon is always able to influence this time factor favorably in one respect namely early prompt diagnosis.

In a previous study of 66 of our cases of penetrating abdominal wounds, it was found that surgical exploration with negative results had been performed on 14 occasions without death resulting from the procedure. This seemed a rather high incidence of surgical exploration with negative results, but on the other hand there was real compensation in the knowledge that there were no deaths resulting from failure to operate because of a missed diagnosis. It has always seemed safer to work on the hypothesis that if doubt exists, operation should be carried out, and this applies more strongly to injuries of the colon than to most other acute surgical conditions in the abdomen.

It is rarely possible to do more than to postulate that the large bowel has been injured. Whether or not the large bowel has been damaged is of sec-

TABLE I — THE TIME LAG BETWEEN WOUNDING AND OPERATION IN RELATION TO MORTALITY RATE: 110 CASES (JARVIS BYERS AND PLATT)

Time, Hours	Cases	Mortality Per cent
to 6	40	30
6 to	54	
to 12	30	30
12		30
Over		100

ondary importance to the decision that the abdomen must be opened but the large bowel was always considered to be the probable location of damage because of the need to plan the proper incision. In rectal injuries a positive knowledge of the site of injury is very important for if the injury is limited to the extraperitoneal portion of the rectum the abdominal operation can be confined to a McBurney type of colostomy as was performed in case 56.

Extraperitoneal wounds of the bowel very easily may escape undetected, unless they are expected in relation to the primary wounds and are carefully eliminated as a possibility. The peritoneal cavity may present a completely clean appearance with no damage otherwise to important structures. Search of the suspected region nearly always will disclose some degree of retroperitoneal extravasation of blood. The mobilized gut, when it is inspected for damage does not exhibit changes as readily over its unperitonealized surfaces so that great care must be exercised to insure detection of small, punctate wounds. Extraperitoneal injuries of the rectum do not lend themselves so readily to direct inspection from within the abdomen, nor is this necessary or desirable. Missiles which enter through the buttock, perineum and thigh can produce the same kind of injury, limited to that portion of the rectum not covered by peritoneum.

We found no new aids to diagnosis. The same reliance was placed on judgment and physical observations that is employed in the diagnosis of any acute condition of the abdomen. Great care was taken to examine the thorax thoroughly because of the possibility that the abdomen had been penetrated through the diaphragm. The frequency of occurrence of abdominal splinting in wounds completely confined to the thorax emphasized the importance of the roentgenogram in the localization of shell fragments or bullets, and in helping to plot the course of such missiles. It was found dangerous to rely too greatly on one's ability to outline the course a missile had taken because the position of the victim's body at the time he is hit can drastically change the path the missile will follow. Case 15 illustrates this feature: the patient in this case would have been operated upon much earlier and would have been saved a long ride in the ambulance, if the surgeon in the field hospital had not made the mistake of assuming that no abdominal viscera had been penetrated.

The buttocks, perineum and anus were carefully inspected, because the largest proportion of injuries to the rectum occurred after wounds had been inflicted in these regions. Digital examina-

tion of the rectum was very helpful in the detection of wounds of the anus or those situated low in the rectum and in the demonstration of blood in the feces. In addition proctoscopic examination should be performed for in several instances proctoscopy disclosed small penetrations of the rectal wall which might otherwise have been undetected.

#### PREOPERATIVE CARE

The preoperative care was concerned mainly with the treatment of shock. A unit of plasma was administered after blood for typing and cross-matching had been taken. Sometimes 2 but rarely 3 units of plasma were given. In general our experience seemed to indicate that neither plasma nor isotonic solution of sodium chloride could take the place of blood in combating the shock and that the administration of plasma was essentially a temporary measure used while blood was being obtained. The degree of shock varied considerably but even those patients who did not seem to be in shock received at least 1 unit of blood in most cases preoperatively. The hematocrit reading was taken routinely at the time of cross-matching but we found it much more practical to rely on the blood pressure, pulse rate, and general appearance of the patient.

No hard and fast rule was followed in the use of a definite value for blood pressure or pulse rate to indicate that the patient had reached the optimal time for operation. The rapidity with which the systolic blood pressure rose to and above 80 mm. of mercury consistent with a pulse which became less rapid and of good quality was a favorable sign. The stability attained at this level of improvement was even more important. The patient who relapsed into shock upon being moved no matter how slightly always constituted a poor risk.

In general a systolic blood pressure of 80 mm. of mercury or more was considered desirable before the patient was moved to the operating room but there were occasions when this level was never reached. In a great majority of cases the systolic blood pressure was more than 100 before the patient was moved to the operating room.

The amount of blood transfused preoperatively varied anywhere from 500 to 2500 c.c. When the condition of the patient was more serious the rapid transfusion of blood was very helpful and the blood was transfused under pressure. At times 2 units were transfused simultaneously. In the presence of venous collapse the ordinary indirect gravity method of administration even with the blood under pressure in the Baxter bottle did not

produce an adequate flow. A two-way stopcock can be interposed between the bottle and the vein in these cases, and the blood can be injected by means of a syringe.

The patients with thoracoabdominal injuries required special attention. The added disturbance to the thoracic mechanics increased the distress of the patient and aggravated the state of shock. If the injury was simple hemopneumothorax with out much damage to the lungs and no tension, aspiration of air and blood from the pleural cavity greatly improved the picture. Sucking wounds were temporarily controlled with an occlusive dressing. In the presence of tension pneumothorax, a catheter was placed in the second interspace anteriorly and negative pressure was maintained by attachment of the catheter to a tube placed under water. Thoracic pain was either relieved or controlled by intercostal nerve block, repeated at intervals if necessary. The aspiration of blood and mucus into the bronchial tree was a frequent occurrence, and unless they were removed, they delayed all efforts to improve the thoracic situation. Blood and mucus would accumulate not only on the side on which damage to the lung occurred but frequently on the opposite side. This feature presents a distinct operative hazard, because the patient must be turned on the side which is not injured when the operation on the thorax is being carried out—an action which diverts additional intrabronchial fluid to the lung which is carrying the main load. Early in our experience we lost several patients with thoracic injuries because of failure to realize the importance of obtaining a relatively dry bronchial tree before we proceeded with the operation.

The removal of these secretions was satisfactorily accomplished with the least disturbance to the patient by means of a catheter inserted into the trachea, through either the nose or the mouth, with the application of suction. Oxygen was administered by means of either an intranasal catheter or a mask, according to which method was tolerated the best.

Once the thoracic mechanics were controlled, either the patient was kept flat or his head and chest were placed in a slightly elevated position. In spite of the fact that the Trendelenburg position will demonstrably improve shock as manifested by small increases in the blood pressure, this position was rarely used in the cases of abdominal injuries. There was always the fear of extension of the upper abdominal and subdiaphragmatic spread of peritoneal soiling, moreover, those patients who had thoracic involvement did not breathe as easily in this position as in others.

It was often necessary to compromise between a thorough examination and what must be termed an adequate examination while the patient was in shock. Our patients were never moved off the litter from the time of admission until they were anesthetized on the operating room table, except under rare circumstances. The danger attendant on moving them too much even while they were on the litter made a meticulous physical examination impossible until their condition improved, but attention was always directed to the recognition and remedy of factors which would tend to prolong shock. This applied particularly to the proper splinting of fractures and attention to hemorrhage from wounds.

The bladder was always catheterized for diagnostic purposes. Catheterization not only provided valuable information as to probable injury of the genitourinary tract, but also insured an empty bladder which meant that abdominal signs could be more clearly evaluated. A duodenal tube was placed in the stomach preoperatively in some cases; in others, it was inserted before closure of the abdomen or just before the patient was returned to the ward.

After the necessary roentgenograms had been taken, and if the patient's condition permitted, he was sent to the operating room, usually with blood still running into his vein, and with 2 or more units crossmatched and carried by the litter bearers.

#### IMPORTANT FACTORS IN THE PROGNOSIS AND TREATMENT

*Multiplicity of wounds.* Extra abdominal wounds.—Many of our patients had multiple wounds situated elsewhere in the body but in only 2 (cases 66 and 69) could death be attributed to these wounds. One man (case 66) had an additional penetrating wound of the head, with extensive damage to the brain which in itself might have been fatal. Needless to say this does not minimize the important effect that multiple wounds may add to the traumatic shock or the hazards to be encountered if they are forgotten or inadequately treated. This recalls an instance in which a desperately ill patient had been treated for severe abdominal injuries in a field hospital. A penetrating wound of the knee joint had been inadequately treated, and a large foreign body had been allowed to remain in the joint. Suppurative arthritis then developed, and the destroyed joint later was resected to overcome sepsis.

Involvement of the spinal cord or cauda equina was seen 6 times in our series. Four of the patients died which indicated that this combination of wounds is of most serious importance, and is a

TABLE II.—MORTALITY RATES IN WOUNDS OF THE LARGE INTESTINE WITH WOUNDS OF OTHER ABDOMINAL VISCERA VERSUS THOSE IN WOUNDS OF THE LARGE INTESTINE ALONE, IN CASES IN WHICH OPERATION WAS PERFORMED

Series and organs involved	Cases	Deaths	
		Number	Per cent
Present series			
Multiple organs	30	13	43
Large intestine alone	18	5	28
Series of Porritt			
Colon alone	77		1
Colon combined with other viscera	63		69

combination that should be approached with great caution.

The combination of thoracic and abdominal wounds with penetration of the diaphragm occurred in 6 cases, and in 3 of these the patients died.

Intra-abdominal wounds.—Agreement on the point that wounds of multiple abdominal organs increase the mortality rate associated with wounds of the large bowel is so nearly unanimous that little space need be given to the subject. Our figures in this respect are seen in Table II in the same table are some interesting figures cited by Porritt from the British and Canadian 21st Army Group in World War II. Porritt's mortality rate accompanying wounds of the colon alone was 11 per cent, our mortality rate for wounds of the large intestine alone was 18 per cent. These rates seem remarkable.

One interesting feature was that in 39 of our 70 patients more than one abdominal viscus was penetrated; this does not include the instances in which the same viscus might have sustained multiple perforations. The additional viscera involved were the liver, kidney, spleen, jejunum, ileum, stomach, urinary bladder, gall bladder and pancreas. Frequently, these other structures had sustained damage sufficiently serious to have played the major if not the deciding part in the outcome for the patient. There were no cases of major intra-abdominal vascular damage in this group although extensive bleeding from the small vessels in the mesentery and wall of the gut was encountered. In the 2 instances (case 45 and case 28) in which the patients died after extensive shock had prevented surgical treatment, the intra-abdominal bleeding had been a major factor.

Shock. Jarvis, Byers and Platt said concerning abdominal wounds, "The seriousness of the shock picture is the most reliable prognostic sign.

TABLE III.—THE RELATIONSHIP OF SHOCK ON ADMISSION TO MORTALITY IN 125 CASES OF ABDOMINAL WOUNDS (JARVIS, BYERS, AND PLATT)

Shock, degree of	Cases	Mortality Per cent
None	37	10.3
Moderate (blood pressure less than 100 systolic, pulse more than 80 and objective signs)	35	31.4
Severe (blood pressure less than 70, (systolic) pulse more than 80, and objective signs)	33	60.6

TABLE IV.—RELATIONSHIP OF SHOCK ON ADMISSION OF PATIENT TO MORTALITY IN 957 CASES OF GASTROINTESTINAL PERFORATION<sup>1</sup>

Blood pressure, on admission <sup>2</sup>	Cases	Average time lag, hours <sup>3</sup>	Mortality Per cent
10 to 40	40	8	66.4
41 to 70		0.7	50.4
71 to 100	50	.6	38.0
101 to 120	46	10.4	8.1

<sup>1</sup> Cases reproduced from the data submitted to the Army by T. J. Jarvis, M.D., in millimeters of mercury.  
<sup>2</sup> Systolic.  
<sup>3</sup> Interval in hours between the time of wounding and the time of operation.

In those cases not exhibiting clinical shock, mortality is less than 10 per cent, while in those in profound shock mortality is more than 60 per cent. They presented a table (Table III) based on 125 cases. Imes (19) also presented the relationship of shock to mortality (Table IV).

Tables III and IV show that the mortality rate in abdominal wounds bears a direct relationship to the degree of shock present on admission of the patient to the hospital. Shock which occurs during the operative procedure also seems of importance as a prognostic guide. Shock was recorded as being present during the operative procedure in 27 of our 68 cases in which operation was performed for large intestinal wounds. Sixteen of the 27 patients exhibiting shock during the operation died, a mortality rate of 59.2 per cent. Among 41 cases of operation for wounds of the large intestine in which shock was not recorded during the operation, death occurred in only 1 case.

We think therefore, that if shock is present before or during the operation as little surgical treatment as possible should be carried out, compatible with saving the patient's life. In such cases, extensive mobilization of the colon should be avoided and a faster less shocking procedure should be employed in the treatment of wounds of the colon, if feasible.



TABLE V — THE RELATIONSHIP OF CONTAMINATION OF THE PERITONEUM TO MORTALITY (JARVIS BYERS AND PLATT)

Condition	Cases	Deaths	
		Number	Per cent
No peritoneal perforation of hollow viscera	33		
All intraperitoneal perforations	60	35	58
Perforations of stomach and small intestine only	43		70
Perforations of colon	57	26	46

*Fecal contamination* Jarvis, Byers and Platt wrote Contamination of the peritoneum by colon content is the single most lethal factor producing death in abdominal wounds. They present a table (Table V) to support this statement.

In our cases in which gross fecal contamination of the peritoneum by the contents of the large bowel was recorded, we noted that the mortality rate was more than twice as high as in cases in which no such contamination was recorded. Extra peritoneal wounds of the rectum are not included in this analysis (Table VI). It is interesting to observe that 64 per cent of the patients with this type of gross contamination had been in shock preoperatively. This emphasizes the role of peritoneal contamination in the production of shock. Of the 7 patients who were in a state of shock before operation, all died except 1.

Peritonitis as seen after rupture of an acute appendix, with the diffuse spread of seropurulent fluid, never was encountered. What were seen, instead, were general or local accumulations of blood most often mixed with intestinal contents, and associated with varying stages of peritoneal irritation. The peritoneum was reddened to a greater or lesser extent, in direct proportion to both the amount of contamination and the time that had elapsed since the injury. The men in cases 11 and 67 exhibited this picture to a marked degree and it is believed that it was an important factor in the profound shock sustained by these men.

TABLE VI — THE RELATIONSHIP OF GROSS CONTAMINATION OF THE PERITONEUM BY CONTENTS OF THE LARGE BOWEL TO MORTALITY

Condition	Cases	Deaths	
		Number	Per cent
Gross contamination		7	64
No gross contamination	42		8

TABLE VII — THE RELATIONSHIP OF TIME LAG TO MORTALITY IN 1 222 WOUNDS OF THE LARGE INTESTINE (CHURN AND HAUVER)

Time interval, hours	Cases	Mortality Per cent
to 6	136	31.3
6 to	373	37.4
to 1	168	51.7
1 to	66	39.3
48		73

In our cases cellulitis and the formation of abscesses were rarely encountered at operation which is only natural, when one considers the time interval. One patient (case 12) was found to have early phlegmonous cellulitis of the entire ascending portion of the colon with involvement of the regional retroperitoneal tissue. In another man (case 37) a small retroperitoneal abscess adjoining a damaged descending colon had already developed. In both of these patients the interval between the time of wounding and that of operation was long.

*The time lag* The surgeons in World War I were unanimous in their emphasis on the need for early operation and speed during the procedure. They advised a short period of resuscitation with rest and the use of warmth and stimulants in most cases of shock. The surgeons of World War II for the most part placed much less emphasis on early operation and on speed during the procedure. Some of the ideas of and results obtained by surgeons with much experience in abdominal wounds in World War II follow.

Hurt wrote A short time-interval is desirable, particularly in the presence of increasing peritoneal contamination and continuing hemorrhage. In our experience a short time-interval has not contributed materially toward a decreased mortality in intra abdominal injuries because some of the most severely wounded came to surgery who would have died had the time-interval been longer.

Jarvis, Byers, and Platt gave the figures seen in Table I for a series of 110 cases of abdominal wounds with intraperitoneal perforation of a hollow viscus.

Imes (17) thought that in abdominal injuries the extent of the wounds and the presence of shock are so much more important that they may eclipse the time lag itself. His impression was that infection which is so greatly influenced by time lag has been greatly diminished as a factor in mortality as a result of chemotherapy. He presented

TABLE VIII.—THE RELATIONSHIP OF TIME LAG TO MORTALITY IN 247 CASES OF ABDOMINAL WOUNDS (OGILVIE 28)

Lag, Hours	Cases	Mortality Per cent
0	15	20
6 to 1	76	3
to 12	41	90
12 to 24		28
Over 24	35	31
Not known	0	

a group of cases from an auxiliary surgical group reported by Chunn and Hauver (Table VII)

Ogilvie (28) said, An increased time lag works both ways, but chiefly toward a lower operative death rate. Delay brings peritonitis but it also eliminates the worst cases [Table VIII]

Bradford, Battle, and Pasachoff wrote 'Our experience has shown that the time interval before operation is not the most important factor in determining mortality rates unless there is evidence of continued internal bleeding or evisceration. We have had good results with some patients operated on over 36 hours after injury

In Morgan's series of wounds of the rectum the mortality rate was about the same whether there had been a long or a short interval between the time of wounding and the time of operation

Laufman, who reported 35 cases of penetrating wounds of the extraperitoneal portion of the rectum with 3 deaths, noted that there was an average time lag of 21 hours, with extremes of 8 and 55 hours. One patient, who had a perforation of 1 cm. was seen 6 days after he had been wounded he was treated without operation and had no complications during the 2 days his condition was followed up. One patient seen 38 hours after he had been wounded was operated on and was found to have spreading pelvic cellulitis, which was treated by drainage of the perirectal space. At the time he died he had in addition to this infection a clostridial gas-producing infection of the thigh

Our own experience is presented in Table IX. Only the 53 of our 70 cases in which the time interval was recorded are presented in this table

On the basis of the tables presented herein, it would seem that the time between wounding and surgical treatment was of almost no importance. But common sense tells us otherwise. There are many facts that we do not know. These tables deal with the men who underwent operation, which involves the selection of individual surgeons. Many surgeons operate first on those patients who con-

TABLE IX.—RELATIONSHIP OF TIME ELAPSING BETWEEN WOUNDING AND SURGICAL TREATMENT TO MORTALITY IN 53 OF 70 CASES OF WOUNDS OF THE LARGE INTESTINE PRESENT SERIES<sup>1</sup>

Time Interval Hours	Cases	Deaths	
		Number	Per cent
Less than	0	6	3.5
to 24			45.4
24 to 36			
Over 36			50

<sup>1</sup>Of the total series of 70 cases concerned in this article, these 53 are the ones in which the time interval was recorded. Of the time interval in the remaining 17 cases we have no knowledge.

stitute the worst risk. Only those patients who reached a hospital are represented in these tables. Among those who did not reach a hospital, what role did the time lag play? Obviously in a patient with a severed artery the time lag can be the difference between life and death.

We think the time lag is of great seriousness in certain cases in which the situation is desperate, as we shall indicate in the section of this article dealing with desperate conditions. However the time lag in the usual case does not seem to be of too much importance. Certainly many patients with serious wounds of the colon and rectum become well despite a time lag of many hours and even days. This change in attitude toward the time lag from that held in World War I is due in great part to new methods of shock therapy in the field. The modern system of supply of blood and plasma is of tremendous and obvious value to the patient a general condition. The sulfonamides and penicillin probably also were of considerable value.

The importance of the time lag should not be minimized however. In abdominal wounds, and especially in those involving the colon and rectum, severe contamination may be present, with the loss of blood into the damaged tissues. We think every effort should be made to shorten the time lag. We believe that the best results are secured by getting the patient in condition for operation as quickly as possible after injury

**Evisceration** Evisceration of the omentum or of the small or large bowel, was seen in cases 18, 32, 34, 35, 39, 40 and 52. There was 1 death in these 7 cases, a mortality rate of 14 per cent. The incidence of this complication in our 70 cases was 10 per cent.

**Management of the patient in desperate condition** Many agree that the time lag is most important for the more desperately injured patients who have

responded poorly to shock therapy. Some of these were not operated on, but were left to die. In many reported series of abdominal wounds the condition of the patients considered inoperable often is described as moribund. Some of these patients, if operated on might have been saved but if left alone they usually die. They constitute an interesting group and one which has stimulated considerable thought. In this respect, we shall present some of the ideas of surgeons who have had considerable experience with abdominal wounds in World War II.

Jarvis, Byers and Platt wrote

It has been generally agreed by surgeons of this war that with few rare exceptions, celiotomy and surgical repair are indicated in any wound involving the contents of the peritoneal cavity and also in wounds of the extraperitoneal rectum in order to divert the fecal stream. With this in mind we have operated upon every patient regardless of risk, believing that even though there be but the slightest chance of survival, we have been unable to take the responsibility for decision not to operate. The occasional survival of a patient who has suffered what has appeared to be a lethal wound has strengthened us in this attitude.

Regardless of time lag it has proved profitable to operate upon all patients with intraperitoneal perforation of a hollow viscus. After an adequate replacement of blood and plasma loss, in an hour to an hour and a half's time, if there is little or no response to shock therapy there must be active causative factors responsible. In the main there are four such mechanisms, most of them amenable to surgery: (a) continued hemorrhage usually concealed; (b) severe fecal contamination of the peritoneum; (c) disturbance of the cardiorespiratory mechanism from thoracic injury; (d) early, fulminating anaerobic infection with gas-forming organisms. Blast injury to viscera and massive evisceration less frequently prevent response. If there is no response to shock therapy or if response has begun but is interrupted and the patient's condition begins to deteriorate operation is begun without delay.

Bradford, Battle and Pasachoff wrote

"Our policy has been to restore these patients to the best possible condition prior to operation regardless of the length of time that has elapsed between the time of injury and the time of admission. Usually a patient with a blood pressure of below 80 systolic will not tolerate major surgery. However we have seen some patients who despite the usually adequate shock therapy do not respond by increased blood pressure. We feel that these patients, too, deserve the benefit of surgery even

though the prognosis is not hopeful for their surviving the operative procedure. Of our 63 post operative deaths 17 occurred during the operative procedure. Had we not attempted operation these patients would surely have died but would have been considered nonoperative deaths. However we have had a number of similar cases who appeared as hopeless operative risks but did survive major operative procedure to go on to recovery. It is this group of patients that has made worth while the undertaking of surgery in the bad risk cases."

They presented the following example of a patient who constitutes a bad risk and for whom the final result was successful.

Case 1: A soldier wounded 9300, July 28, was admitted to the hospital 1,500, same date. He had a penetrating wound of the left chest due to bomb fragment. He was in profound shock, dyspnea was marked, and pulse was very severe. There was external bleeding from the wound, and physical examination suggested the presence of a left hemothorax. Roentgenologic examination disclosed the presence of fluid in the left chest and also bomb fragment in the abdominal cavity.

One thousand cubic centimeters of whole blood were given. The blood pressure failed to rise above systolic 64, diastolic 40. Because the patient showed evidence of continued bleeding he was prepared for immediate operation. Under intratracheal positive pressure anesthesia with nitrous oxide, oxygen and ether open thoracotomy was performed. The chest cavity as found to contain omentum and the transverse colon, the latter almost completely transected, fecal contents were free in the pleural space. A severely lacerated spleen, bleeding actively, as also present in the chest cavity. The left lower lobe of the lung as found to be lacerated.

The operative procedure consisted of suture of the laceration in the lung, splenectomy and repair of the multiple lacerations in the diaphragm. Closed system catheter drainage was provided. The abdominal cavity was then explored through midline incision and all blood was aspirated from the peritoneal cavity. The severed ends of the transverse colon were brought out through stab wound as colostomy. The abdomen as closed without drainage.

The patient, as given 1,000 c.c. of whole blood during the operation during which time his general condition remained unchanged. Postoperative therapy included an additional 500 c.c. of whole blood and continuous intranasal administration of oxygen. Wengertsen drainage as instituted and continued for 3 days. The patient as given 40,000 units of penicillin every 4 hours and sulfadiazine (maintain blood level of between 3 and 1 mgm. per 100 c.c.). A total of 35 gm. of sulfadiazine and 80,000 units of penicillin as given.

The patient had mild postoperative course. The highest temperature postoperatively was 100.6° F. pulse 30. Drainage from the catheter in the pleural space was considerable. The catheter as removed on the third day. Hematoma was present for the first few days but cleared. On the seventh day 800 c.c. of straw-colored fluid was aspirated from the left pleural cavity. The patient's progress had been considered satisfactory and he was therefore evacuated to rear hospital on the ninth postoperative day.

Beecher said

"In other cases an individual's wound may be such that definitive surgery is a necessary part of his resuscitation when profuse internal bleeding is occurring it is wasteful of time and of blood to attempt to get the patient's blood pressure up to normal. One should consider himself lucky if a systolic pressure of 80 to 85 mm Hg can be achieved and then surgery undertaken. This applies as well to other common conditions where full resuscitation is often impossible until the situation has been corrected surgically for example where wide fecal contamination of the peritoneum has occurred where leakage into and possibly absorption from, devitalized tissue is in progress.

We think that patients who do not respond to shock therapy after it has been employed briefly and vigorously for an hour or two and patients who do respond to such therapy but then begin to relapse have their only chance in operation and that they should be given this chance. The condition of our 2 patients (cases 45 and 28) who were not operated on was somewhat similar to the condition of the patient in the case quoted from Bradford Battle, and Pasachoff. The condition of our patient (case 67) who was operated on was a very similar type of desperate condition we lost this patient during the induction stage of anesthesia. Injury from blast or fulminating infection with anaerobic gas-forming organisms elsewhere in the body should be ruled out as a cause for shock before abdominal surgery is attempted.

#### OPERATIVE TREATMENT OF WOUNDS OF THE COLON IN GENERAL, AND OF COMPLICATIONS

The operative treatment of wounds of the large bowel still is a field of controversy. There are those who think that all wounds of the colon that can be exteriorized should be exteriorized. Others still believe that suture alone has a place of importance. A consideration of the different methods and pertinent facts concerning them needs reviewing. This we have done, and we shall present our results in this section. Because wounds of the colon and wounds of the rectum present different problems they will be considered separately.

**General considerations** Before beginning the operative procedure on a wound of the colon the surgeon must bear in mind the fact that this type of wound in general is severe and that the morbidity and mortality rates are high. The general condition of the patient must be carefully considered and observed. Shock was the cause of death in the majority of our cases in which the out-

come was fatal. Thus, as a rule the less shocking the procedure employed, the better.

The procedure chosen should prevent sepsis, which so often is the result of the wound in the colon. It should also prevent debilitation. When ileostomy is performed debilitation is threatened because of the loss of nutrition which the ileostoma entails especially in respect to fluids.

In the operative treatment of wounds of the colon the following five methods are commonly employed individually or in conjunction with each other.

First, the wound in the colon may be sutured. When this is the only method used it is called 'simple suture, primary suture suture alone or suture with replacement. All these terms mean that the sutured wounded segment of colon is left inside of the abdominal cavity.

Second, deviation of the fecal stream from the wounded segment of colon may be accomplished. This procedure usually is carried out in the form of a colostomy performed proximal to the wounded part of the colon. It is often combined with suture of the wounded portion of the colon and is then spoken of as suture with proximal colostomy. Ileostomy or ileocolostomy can be performed.

Third, exteriorization may be used. This may imply anything from the bringing out of a small tear at the apex in a loop colostomy to resection of a damaged segment of bowel and the bringing out of the ends as in the performance of double-barreled colostomy.

Fourth resection may be done. This term applies to resection of the wounded portion of colon regardless of what is done with the remaining part, such as exteriorization suture, or anastomosis.

Fifth drainage from a retroperitoneal wound to the exterior may be established. This is done occasionally through the flank for retroperitoneal wound, of the ascending and descending portions of the colon, and is often used for extraperitoneal wounds of the rectum.

Historically these basic methods are not new. In World War I all were used. The following is quoted from *The Medical Department of the United States Army in the World War* (26).

"The general principles to be followed are Suture whenever possible to secure a satisfactory closure, and always employ a double row of sutures. Avoid resection colostomy is to be preferred. Colostomy is to be advised with large ragged openings, particularly those occurring in the cecum, descending colon and sigmoid. The wounds that are sutured do better than those in which an artificial anus is employed the latter group gives the high mortality of 70 per cent.

TABLE V.—RESULTS OF SURGICAL TREATMENT OF WOUNDS OF THE COLON IN WORLD WAR I COMPARISON WITH OGILVIE'S SERIES IN WORLD WAR II

Series	Mortality rate Per cent
Wallace, 947 (37) (Operated patients)	23.7
Fraser and Drummond, 97 (83 cases of surgery of colon)	25
United States Army (26) (No statement as to surgery)	30.6
Drummond, 91 (37 cases of surgery of colon)	45
Ogilvie, 211 (128)	7

In the British Army Fraser and Drummond who had a large experience with wounds of the colon in World War I discussed the question of treatment thus:

"The actual operative treatment may be summed up in the following methods (1) Simple suture, (2) Suture with a proximal colostomy, (3) Colostomy at site of injury. The operation of resection may be left out of account. It is rarely advisable to practice it in this type of surgery.

"At first we followed the practice of a proximal colostomy in combination with the operation of suture. There are the obvious advantages that it increases the safety of the suture while it obviates the passage of fecal matter through the damaged gut. At this time we were suspicious regarding the viability of the line of colon suture and we felt that the colostomy added greater security. Later we recognized that the performance of proximal colostomy was rarely necessary and we have therefore almost abandoned its use. We now reinforce the suture line by an omental graft. We believe that our results have improved since we have altered our procedure. When the wound of the colon is very extensive colostomy at the site of injury is the only possible procedure.

Thus, the opinion of the surgeons at the end of World War I was that suture was the method of choice except in large wounds, for which colostomy performed at the site of injury was the treatment of choice.

During the interval between the two world wars little advance was made in the operative treatment of wounds of the colon and rectum. Generally suture of the wound was employed when possible, and exteriorization was reserved for large wounds of the colon. The mortality rate among civilian patients remained high. The mortality rate in wounds of the large bowel reported by Rippey was

62.5 per cent by Wilkinson and associates, 62.5 per cent when only the large intestine was wounded and 79.3 per cent when there were wounds of other viscera also and as reported by Elkin and Ward, 53 per cent. These percentages constitute a good cross section of the mortality rates in cases of injuries in civilian life in this country. In abdominal wounds among civilians the patient often is brought to a hospital and operated on early whereas in the surgery of war the delay is much longer which largely eliminates the patients who have sustained injuries to large vessels, such as would be seen in civilian hospitals. In other respects, also there are differences. It is noteworthy however that in none of the civilian series were the amounts of blood and plasma administered as large as those employed in the army series in World War II.

With World War II came the wide application of exteriorization with disuse of the suture method. Now that the war is over it may be of value to consider the results from World War II as contrasted with those from World War I, and to try to evaluate the place of the main operative procedures at our disposal.

Today in war surgery among the Americans and British the general practice is not to employ suture of wounds of the colon, but, instead, to use exteriorization of the wounded segment of colon. Great emphasis has been laid on this method by the British and American army surgeons. Cutler, in reviewing the military surgery of the United States Army in the European Theater of Operations, remarked "All large bowel injuries should be exteriorized by the simplest method available.

Injuries below the rectosigmoid, which cannot be exteriorized must be closed and a complete diversion of the fecal stream carried out proximally to the sutured area."

This, then, was the policy of our army in Europe. Exteriorization was widely used by the British army in Africa and in Europe.

*Exteriorization.* Some attempt may now be made to evaluate the procedure of exteriorization which has gained such wide favor in the treatment of wounds of the colon. To do so other operative procedures must, of necessity be considered, especially suture with replacement and suture with replacement combined with proximal colostomy.

Ogilvie (28) in World War II came out strongly in favor of exteriorization in almost all wounds of the colon. His policy was employed in the British Eighth Army in the western desert of Africa and the results were encouraging. There were 86 deaths in the 160 cases of wounds of the colon treated surgically and reported by him, a mortality

rate of 53 per cent. It is seen when this rate is compared with figures from World War I that it represents a definite improvement (Table 10).

When the colon was the only abdominal organ injured, Ogilvie (28) listed 37 cases associated with a mortality rate of 40 per cent. Wallace in 1917 reported a mortality rate of 58.7 per cent in cases in which no other lesion of the alimentary tube was present. Wallace's figure was based on 965 cases of abdominal injuries treated surgically in which the colon was wounded 252 times. As compared with the World War I figures Ogilvie's results are much better than the figures would indicate as is shown by Ogilvie's analysis.

In comparing this series with any in the last war it must be pointed out that the conditions of operating in the Western Desert were at most times far worse than in a C.C.S. in France and that many more severe cases were tackled than ever reached the operating theater in 1918. Then many men died at Field Ambulances, and of those reaching a C.C.S. 20 per cent were regarded as moribund and unfit for operation. Even in the comparatively mild group of injuries limited to the alimentary canal, it is noteworthy that in the Middle East series 45.4 per cent of the wounds involved structures other than the small intestine in the last war series only 32 per cent. Every man that could be resuscitated was resuscitated, and every man that could be brought to the table alive was tackled unless there was another with a better chance in urgent need of surgery at the same time. It is probably true to say that two-thirds of the men who died in the first 24 hours (i.e. 42) would have been excluded from 1918 statistics.

A further point of difference is that 98 per cent of these patients were traced to the base, whereas in the figures of the last war most of the statistics deal with survivals in the forward units only. On such a reckoning 25 of the deaths in this series would have been recorded as survivals.

In 1946 Ogilvie (29) had this to say regarding wounds of the colon:

"I felt at the beginning of the war (World War II) that the increased safety brought to civil surgery of the colon by the principles of exteriorization and proximal exclusion pointed the way to improved results in war surgery. I made a big point of this in a lecture in 1940 from which I quote the following:

There has been a marked tendency in recent years to look on the large intestine with increasing respect or even fear. Its walls are thin its blood supply is poor and the peritoneal coat is interrupted by a broad mesentery and distorted by fat

blisters, the contents are highly infective and mechanically traumatic its luminal pressure alters with explosive suddenness. No sutures can be placed accurately in its wall and what are thought to be leiberts often pass through all coats and carry infection. All surgeons have experienced trouble with leakage and sepsis at the suture line after resection and many feel today that no stitch should ever be put through a colon that is not both empty and sterile. A colostomy or a resected loop should not be stitched to the skin but the skin opening should be made to fit the colostomy, a segment of bowel should not be excised and the ends sutured unless the contents have been diverted above by an excluding colostomy for at least two weeks. Devine has shown the way to success in cancer of the colon by his operation of exclusion and Lahey has made resection of the rectum for cancer and of the colon for ulcerative colitis safe by stage operations in which the bowel is brought to the surface. In war injuries the way to safety is the same for caecostomy provides only partial relief of tension at the injured site, and proximal colostomy is no better unless it is done some weeks before.

My early experience in the African Campaigns confirmed this view: that is, I saw far more avoidable deaths due to unwise suture of colon wounds than I saw suffering from colostomies or difficulties in closing. The young surgeon fails to appreciate that a small hole in the colon caused by a projectile is really a small hole surrounded by a much larger area of devitalisation that will eventually slough. When he has learnt the limits of good and evil, that is the point when tissues cease to be viable even though they look good he can begin to use his judgment. In practice, to an experienced abdominal surgeon the nearer a wound is to the ileo-caecal sphincter the more often it can be sutured, the nearer to the rectum the more often it must be exteriorised. But when suturing large intestine wounds I feel that drainage down to the lesion is always wise and a proximal decompressing or defunctioning opening usually so.

He continued and discussed the place of suture alone, suture with proximal colostomy and exteriorization. Then he discussed the treatment of the right and left portions of the colon.

1 Suture alone should, I think be reserved for small holes in the caecum or the mobile part of the ascending colon. The surgeon must be sure that his infolded suture line is through completely healthy bowel wall, and he will be well advised to lead a small drain down to it.

2 Suture with proximal colostomy is clearly right for wounds of the rectum that can be sutured

TABLE XL.—WAR WOUNDS OF THE LARGE INTESTINE: METHODS OF OPERATIVE TREATMENT AND MORTALITY RATES THEREOF, VARIOUS REPORTED SERIES

Author	Primary suture			Suture proximal colostomy or caecostomy			Exteriorisation without resection			Resection with ileo-transverse colostomy			Resection with exteriorisation			Resection with anastomosis (colo-colostomy)			No operation		
	Cases	Deaths	Mortality, Per cent	Cases	Deaths	Mortality, Per cent	Cases	Deaths	Mortality, Per cent	Cases	Deaths	Mortality, Per cent	Cases	Deaths	Mortality, Per cent	Cases	Deaths	Mortality, Per cent	Cases	Deaths	Mortality, Per cent
Ogilvie (75)	12	3	41	22	10	45	20	23	94												
Lucas (3)	5												14	64		300			4	100	
Hart				3			20	30				13								100	
Parfitt		3	3				3	27	48												
Freeman series				7	3	43	16	47	47			30								100	
Gillies	8		30				100	0					7		47						
Gordon, 7 year																					
Freeman, Turkey & K. & A.				8			3														
Total	66	5	4			27	50	7	30	3			10		58			64	7	7	100

without mobilisation for no other policy is possible. Suture with proximal caecostomy is permissible to an experienced surgeon in local unlacerated wounds of the right half of the colon.

"3 Exteriorisation is the best method for dealing with the great majority of wounds in the left half and with lacerated or extensive wounds in other parts of the colon that can be exteriorised.

"4 Injuries of the ascending and descending colon are, of course, among the most difficult problems encountered in the abdominal surgery of warfare, particularly injuries in the upper half where the bowel is more fixed and much deeper, where the abdominal wall is fixed by the ribs, and where an injury to the kidney is a common complication. Wounds of these parts, unrecognised or untreated at the time often drain to the surface in the loin, and after leaking faeces for a week or two heal spontaneously but I feel doubtful whether intentional drainage to the surface that is, a lumbar colostomy without mobilisation is permissible. The surgeon in examining and dealing with a wound of this part of the colon necessarily opens up retroperitoneal planes in which anaerobic cellulitis is common and fatal, and if he is making a colostomy it should be well to the surface and not through this deep and dangerous area.

"I can only say that with injuries in the neighbourhood of the hepatic and splenic flexures, the surgeon must do the best he can within the general principles that lacerated tissues must be resected and faeces must not be allowed to leak into the abdomen. If the colon injury is a large one, he

must resect the damaged segment, and somehow bring the ends together. On the left side a double barrelled colostomy will be his aim, on the right he may accept the expedient of resection and suture with less misgiving. In each of these corners, however the problem may arise that, after the minimum adequate resection one or both ends will not come to the surface without dangerous tension, or without further extensive mobilisation that will take time the patient cannot stand, and open up fresh planes to a dangerous extent. To exteriorise both ends at different parts of the abdomen is safe and simple. It leaves a most difficult problem of reconstruction for the surgeon who follows. In such cases end to end suture with proximal colostomy or caecostomy may be the best way out. For extensive injuries on the right side, a classical right colon resection with end to end ileo-transverse anastomosis may easily be the simplest and most rapid and therefore the correct procedure. Anastomosis between small and large intestine has few of the risks of colon to colon anastomosis, since the material passing the suture line is fluid not very infective, and flowing at an even rate and low pressure. In big lacerations around the splenic flexure, which often imply repair of the diaphragm, suture of the fundus of the stomach and removal of the left kidney, double barrelled colostomy may be quite impossible, and end to end suture with wide local drainage and proximal caecostomy or right transverse colostomy will be the most satisfactory method of dealing with a pretty nasty situation.

TABLE VII.—MORTALITY RATES IN THE SURGICAL TREATMENT OF WOUNDS OF THE COLON WHEN ONLY THE COLON WAS INJURED

Series	Procedure employed									
	Suture alone		Suture and proximal colostomy		Exteriorization				Resection and anastomosis, colon-to-colon	
	No	Died, Per cent	No.	Died, Per cent	No.	Died, Per cent	No.	Died, Per cent	No	Died, Per cent
Foritt	3	33.3			95	28.4				
Ogilvie (15)†	4		3	33	N resection		Resection			
						40		00		100

†Patients who did not die of wounds other than wounds of the colon.  
 ‡Patients operated on within 48 hours of time of wounding.

Thus, Ogilvie thought that all three of the methods being considered in this section of the present article as well as resection have a place in war surgery.

Gordon Taylor likewise believed that all three methods and resection have an important place. He stressed exteriorization, and wrote that he thought it should be done whenever possible. He declared that suture with replacement is certainly safe in early tears and lacerations if these lesions are intraperitoneal, but advised that a graft of omentum or an epiploic appendix be used to reinforce the suture line.

**Suture.** Suture alone, with replacement of the sutured colon in wounds of the colon was frowned upon during World War II by the American and British alike. The attitude was that this procedure was unjustifiable the result may be successful, but an unnecessary risk will have been taken. (1) We shall now present some opinions and facts concerning this still controversial method of treatment. As is shown in tables 11 and 12 this method was accompanied by a lower mortality rate than that associated with any other method. When suture was employed the mortality rate was 22 per cent, in contrast to a rate of 39.1 per cent when exteriorization without resection was carried out.

To judge this procedure, the fate of the suture line should be determined that is whether or not leakage occurs. Jolly writing about his experiences in the Spanish Civil War said

"It is only in the treatment of small tangential wounds, or of small perforations of the mobile portions of the colon, that good results may be anticipated from the simple invaginating suture practised so successfully in the treatment of wounds of the small intestine.

"The larger tears and retroperitoneal wounds of the fixed portions of the colon are so often com-

plicated by extensive haemorrhagic extravasations into the intestinal coats or into the mesocolon that suture is both difficult and usually even if carried out carefully by layers, unsuccessful. There is too great a danger of the whole damaged wall of the gut sloughing away on the fifth or sixth day after operation.

Jolly did not mention the use of exteriorization.

Almost no cases were recorded in World War II in which the sutured wound in the colon broke down. Imes (17-19) treated 25 patients with war wounds of the colon by suture alone, and in no instance were there complications arising from leakage the wounds apparently all remained closed. He collected 168 cases in which suture alone or suture combined with proximal colostomy had been the method of treatment. He wrote

From our experience and from what I was able to gather I had a definite belief that many of the perforations would have fared better if they had been treated by that method. As to the size of the perforations which might best be sutured, I would say one under four centimeters in diameter although that is purely an arbitrary figure. I think the location of the perforation in relation to the mesentery is important, since for obvious technical reasons those involving the mesenteric portion of the bowel circumference are more difficult to close satisfactorily.

He thought that extensive mobilization at times necessary for exteriorization, is a most important factor in the production of shock.

Suture alone was used by us twice without any leakage from the suture line (cases 1 and 19). In both instances the wound was small.

Giblin cited 4 deaths in cases in which the injured part of the colon was sutured without performance of proximal colostomy but he did not disclose whether or not leakage from the suture





and Ogilvie (28) Serious septic complications can occur also when the exteriorization method is employed.

As reported by Gordon Taylor and by Roettig and his associates an exteriorized loop of bowel after colostomy can retract down below the level of the abdominal wall and into the interior of the abdomen with disastrous results. We have seen an exteriorized loop of bowel become necrotic and retract into the abdomen. Also fecal material can drain down between the colonic stoma and the wall of the bowel into the abdominal cavity and form an intraperitoneal abscess as probably happened in one of our cases (case 29) Retrocolic abscess occurs.

Jarvis and associates wrote

"The retroperitoneal tissues exposed to extensive contamination by the mobilization of attached colon have been a frequent source of infection. In fact the most frequent situation for the development of abscess next to the subphrenic areas.

Infection sometimes severe, in the laparotomy incision occurs if the wounded portion of colon is exteriorized through this incision. This infection can be serious, and dehiscence can occur because of weakening of the wound by infection.

Acute and complete intestinal obstruction and also incomplete obstruction were reported by Roettig and associates as late complications of exteriorization. Obstruction was not an uncommon complication. In some cases, the small bowel had become adherent at the site of exteriorization. Early, we noted abdominal distention by the accumulation of gas in the colon proximal to an unopened exteriorized loop of bowel. This is relieved simply by cutting across the loop which should be done, as a rule, before a patient is evacuated to the rear.

In the cecum and ascending portion of the colon the performance of colostomy can result, in some cases, in severe and dangerous loss of fluids and valuable nutrition. This material can be of liquid character and it can be most irritating to the skin and damaging to any incisions it encounters.

Shock occurring during the operative procedure of mobilization of a large segment of bowel in order to exteriorize it often complicates exteriorization. This complication has not been emphasized in the literature. We had 24 patients for whom mobilization of some part of the colon was done. Fifteen of these patients went into shock during the operation. Four patients were not in shock during the operation. In 5 cases the condition of the patient was not stated. Ten of the 24 patients died and all 10 were in shock during the operation. On reviewing these cases we believe that the patients

did not seem to be any more severely wounded than others who had sustained wounds of the colon. In some of these mobilization operations other procedures of less shocking nature could have been used. We have noted that mobilization often causes a marked decrease in the blood pressure often is time consuming especially in inexperienced hands, and sometimes is accompanied by soiling of the peritoneum by fecal matter.

*Advantages and disadvantages of exteriorization versus suture.* The advantage of exteriorization lies in the fact that the danger of continued fecal contamination of the abdominal cavity is almost eliminated and that decompression of the large bowel can be effected if the exteriorized portion of bowel is opened. Thus in war injuries, the surgeon feels sure that after exteriorization the source of contamination is safely outside of the abdominal cavity and that distention of the large bowel can be controlled. Patients so treated therefore can be evacuated to the rear under less surgical supervision than those treated by suture alone. The disadvantages of exteriorization are several. The extensive mobilization necessary for exteriorization may so endanger the patient's general condition by the production of shock as to be fatal. Secondary operations are necessary to close the colonic stoma and the nursing problem is made worse by the need for frequent change of dressings.

The advantages of simple suture are its simplicity, speed, nonshocking aspect, elimination of the nursing problem, avoidance of later operations, and shorter convalescence of the patient. The disadvantage is that the suture line might break down with contamination of the abdominal cavity. More surgical supervision therefore is needed at first to insure watchfulness for this complication. Suture with proximal colostomy increases the safety of the suture line and often can be used in place of an extensive shocking mobilization procedure.

*Summary exteriorization suture with proximal colostomy and suture alone.* In summary we evaluate these three methods of treatment in war injuries of the colon as follows. Exteriorization is an excellent procedure, and is our method of choice in most situations if mobilization is not necessary. If mobilization is necessary to exteriorize the wound and if the patient's general condition is poor then the less shocking procedure of suture with proximal colostomy is better. In severe wounds exteriorization is the only choice as a rule, for such wounds cannot be sutured without considerable danger of breakdown of the suture line. In small wounds—those less than 2 or 3 cm in diameter—suture with proximal colostomy is very

safe Suture alone in small wounds probably is a sound procedure. The sutures must be placed in viable gut only. Two layers should be used, and the suture line should be reinforced, if possible, by a graft of omentum or by an epiploic appendix. A drain should be inserted down to the suture line. We think that in war wounds the sutured segment of colon should be safeguarded by some form of proximal deviation of the fecal stream or by exteriorization of the sutured segment. Occasionally in war wounds of the colon suture alone is advisable in selected cases in which damage to the gut is minimal.

**Resection** Resection of a wounded segment of the colon has not been employed often, and no large series concerning such treatment has been reported. Probably no one surgeon has seen resection of the colon done many times for the type of injuries under consideration. Among those men who have had experience with resection under such circumstances there is almost uniform agreement that the procedure is best avoided if possible because it is too severe a shock to the patient. In World War I resection of the colon was considered to be too shocking. In the Spanish Civil War Jolly employed resection of the colon in large wounds of the colon because he found that suture of such lesions resulted in sloughing of the bowel and death. Concerning these large wounds he wrote "It is in these cases, therefore, that resection of the colon, notwithstanding the appalling mortality rate, must be undertaken." He did not use exteriorization.

In World War II resection for wounds of the colon was used to a limited extent. Ogilvie (28) reported 22 cases, with a mortality rate of 64 per cent, in which resection with exteriorization was performed. He also reported 2 cases, in both of which death ensued, of resection of the colon with anastomosis. His views concerning resection have already been presented in this article in the section on exteriorization. He thought resection sometimes is the best treatment for large wounds of the ascending and descending portions of the colon, especially in the ascending portion. Hurt reported 4 cases of resection of the terminal portion of the ileum, the cecum, and the ascending part of the colon, with the performance of double-barrelled ileotransverse colostomy with 1 death. Resection with exteriorization was performed once in the left side of the colon and the patient lived. These procedures were performed only in the presence of extensive injuries in a fixed portion of the colon. Gordon Taylor reported that General Fruchaud successfully performed resection of the right side of the colon 4 times consecutively for severe in-

jury direct anastomosis between the ileum and the transverse part of the colon being done. He cited another successful resection of the hepatic flexure with end-to-end junction. Gordon-Taylor thought that resection is the method of choice in certain conditions, such as when (1) the cecum or colon is in a state of infarction (2) there is extensive separation of the bowel from the mesocolon, especially if the latter is the site of a hematoma or is bleeding actively (3) the vitality of the bowel has been crushed out of existence and (4) the gangrenous ulceration of Hamilton Drummond and Shaw Dunn is present. Thus, he advocated resection when the vitality of the bowel over an extensive area is gone or seriously threatened.

Jarvis and associates wrote "In those long, linear tears, especially in the proximal half of the ascending colon the most satisfactory answer seems to be resection of the proximal portion to beyond the tear ileotransverse colostomy (which we prefer to do in end-to-side fashion) bringing the proximal hepatic flexure or transverse colon out through a stab wound. They did not present cases.

All our own experience with resection was gained with wounds of the right portion of the colon, and it made us extremely wary of resection because of our high mortality rate. Before this series, while we were in North Africa, we carried out, once, resection of the terminal part of the ileum, cecum, and the ascending portion of the colon with double-barrelled ileotransverse colostomy and the patient withstood the operation well. In this series, right colectomy was performed 4 times (cases 5, 9, 11, and 12) at the primary operation. Only one of the patients had wounds other than in the right part of the colon. Two of these soldiers (cases 5 and 9) had arrived at our hospital in good general condition; these 2 survived the resection. The other 2 (cases 11 and 12) had come to us in severe shock. They were prepared by shock therapy preoperatively but during the operation went back into severe shock from which they never recovered. It is our belief that in both of these cases the performance of simpler shorter procedures might have been wiser.

After this, we encountered a patient with a severe tear of the cecum and ascending part of the colon (case 6). We exteriorized the injured part of the right portion of the colon and performed ileotransverse colostomy at the primary operation. Six days later we resected the exteriorized portion of the right part of the colon without anesthesia, and the patient did well.

Our attitude is that resection is a severe procedure to inflict on a patient severely wounded in

the abdomen. If some simpler procedure can be done we think it a wise policy to do it. The general condition of the patient should be considered seriously before any extensive resection of the colon is undertaken.

*Drainage from a retroperitoneal segment of colon to the exterior* Almost nothing has been written about drainage of a wound in the colon through the abdominal wall, as in the flank. In extraperitoneal wounds of the rectum institution of drainage from the outside down to the wound is an important and established method of treatment. In wounds of the retroperitoneal part of the colon such drainage apparently has been used but rarely and almost no reports of cases, analyses, or valuable experience with this method have been recorded in the published series of abdominal wounds.

Berry who was surgical consultant of the American Seventh Army wrote as follows concerning retroperitoneal wounds of the colon. "These wounds are debrided, a direct tract to the wound in the colon established first, then the abdomen opened well explored, and a proximal colostomy performed. He did not mention the results obtained in this method.

Larson (23-24) reported that he used a modification of this method in several cases, with success. He inserted a mushroom type of catheter into the wounds in the retroperitoneal part of the colon, and anchored it in place with a suture. He then brought the catheter and the long ends of the suture out through a stab wound. Traction was exerted to hold the wound in the colon against the stab wound. In one case he removed the catheter after 10 days the wound was healed 10 days later. His patients were operated on immediately after injury. His opinion was that retroperitoneal drainage now can be done with safety in retroperitoneal wounds.

As I have shown Ogilvie (29) in 1946 writing about wounds of the right and left portions of the colon said that he doubted if intentional drainage to the surface—that is, lumbar colostomy without mobilization—is permissible.

We used this method in only one case (case 1) in this series. The patient had two small perforations of the retroperitoneal part of the cecum which were sutured. The injured part of the cecum was not exteriorized but retroperitoneal drainage was established. No complication occurred. In Italy a patient came to us with a wound of the retroperitoneal part of the ascending colon. This had been treated by wide retroperitoneal drainage. He almost died of sepsis and loss of fluid such as occurs after creation of an ileac

stoma. Weeks later ileotransverse colostomy and right colostomy were performed. The end result was good. One patient (case 37) perhaps should have had this type of treatment for wounds of the retroperitoneal sections of both the right and left portions of the colon. Instead these wounded segments were exteriorized. The patient died of shock from this very extensive procedure.

Sound evaluation of this procedure cannot be made on the basis of the available evidence. We feel that perforating wounds of the retroperitoneal portion of the colon should be exteriorized if the patient's general condition is such that he will withstand the procedure. If suture of the wounded segment of colon is employed, without exteriorization proximal deviation of the fecal stream seems definitely advisable. This ought to be accompanied by the institution of drainage from the wounded segment to the exterior.

*Colostomy* An understanding of the colonic stoma from its establishment to its closure is necessary for anyone treating wounds of the large intestine. The colonic stomas resulting from the wounds of World War II were closed with little morbidity and practically without mortality. This being true the surgeon doing the early treatment of wounds of the colon and rectum can establish a colonic stoma with the knowledge that it can be closed later almost without risk.

Both the loop and the spur type of colonic stoma can be closed successfully by either the intraperitoneal or the extraperitoneal method. Thus, at early surgical treatment either the loop or the spur type of stoma can be employed, as the surgeon desires.

A brief glance at the type of work that was done on closure of colonic stomas of World War II is interesting. Roettig and associates operated on 92 patients with colonic stomas or fistulas and only 3 fistulas developed after closure. There were no deaths. Their patients were considered to have no infection, and intraperitoneal end-to-end anastomosis was the routine treatment. Chemotherapy was an important part of the care. Pilcher and Nadeau closed 14 loop colonic stomas extraperitoneally with the development of 1 fistula. They had no deaths. Keene closed 50 colonic stomas or fistulas. Hamilton and Cattinach closed 43. Gregg and Mosely closed 23. Colcock closed approximately 23. In all of the series in this paragraph 243 colonic stomas or fistulas were closed without a death.

In the closing of colonic stomas in the war wounded the surgeon who does the definitive surgical work often is not the one who did the initial operation. Thus he does not know the exact an

atomic situation such as the length of the spur. The surgical notes often are brief. Intraperitoneal closure with direct visualization of the loops of bowel allows the surgeon a better understanding of the situation. Short spurs, twisted loops of bowel, important arteries close to the colonic stoma, and the attachment of small bowel to the site of the stoma have been found at surgical exploration. These could have caused complications if a clamp had been applied blindly to the spur created at colostomy. In intraperitoneal closure the danger of peritonitis is increased. In a few instances among the cases of Roettig and his associates, in which signs of localized peritonitis developed, streptomycin was used and the signs disappeared.

The technique of performance of the spur type of double-barrelled colostomy varies somewhat in different hands. The main principle is to have a

sufficiently long spur to favor spontaneous closure, even though a secondary procedure to accomplish this end may prove necessary. A generous amount of each limb of bowel should protrude beyond the abdominal wall in order to discourage retraction.

Both the loop type and the double-barrelled type of colostomy should be performed through stab wounds, separate from the exploratory incision.

The technique of loop colostomy needs little comment other than that there should be absolutely no tension on the loop. It is most simply accomplished by the passing of a thick rubber tube or a glass rod through the mesocolon adjoining the bowel, and suspending it on the abdominal wall. The peritoneum should fit snugly but not too tightly about the emerging portion of the colon. There is rarely any need to suture the peritoneum to the colon.

*(This review will be continued in the September issue.)*

# ABSTRACTS OF CURRENT LITERATURE

## SURGERY OF THE HEAD AND NECK

### HEAD

Contribution to the Study of Salivary Neoplasms  
(Contribuição para o estudo dos neoplasmas salivares) P. DEBAIVE and J. DUCKERTS. *Arg. pat.* 1943 14 396.

This study is based on 53 cases of salivary neoplasms mostly parotid but including also submaxillary sublingual upper labial palatal and cervical neoplasms observed at the Anticancerous Center of Liège University from October 1925 to October 1941. Besides a complex pathologic anatomy these tumors present a special clinical aspect which makes surgical and radiologic treatment difficult. Histologically the authors distinguish simple epithelial tumors and remanipulated or mixed tumors which may be of localized and invading types. The remanipulated tumors differ from the simple tumors only in the respective relations of their epithelial and connective tissue elements. With the exception of rare adenomas and fibromas all epithelial tumors of the salivary glands are malignant in various degrees independently of their apparent structure. Like the other malignant tumors they possess the property of spreading locally by direct infiltration of the tissue of the involved organ regionally through the lymphatics and distantly through the lymphatic and blood vessels. In the authors' cases death occurred from local and regional invasion metastasis being rare. The growth of these tumors is sometimes slow and progressive sometimes rapid after a slow and progressive development sometimes rapid after an interruption and sometimes rapid from the beginning soon leading to death. Recurrences are very frequent following operation or irradiation there were 18 (32.9 per cent) recurring tumors 13 presenting one recurrence and the remainder developing from two to five recurrences.

The diagnosis must be based on clinical roentgen and histologic examinations. The differential diagnosis must be based on the same elements and, in addition on exploratory puncture which will allow distinguishing the tumors from certain lesions such as caseous bacillary adenopathies biopsy will be the last resort.

The prognosis depends on the histologic nature of the tumor its extent, early intervention treatment used, and the possibility of recurrence. The age at which the tumor appears has a notable influence before the age of 40 and beyond that of 70 the prognosis is more favorable than for the ages in between as the number of deaths increases gradually up to the age of 60 years. Localized mixed tumors as such do not cause death but recur frequently invading

mixed and simple tumors offer about equal probabilities of death.

Treatment must be conducted with the constant idea of avoiding local recurrence. The slowness with which the tumors usually evolve and the relative rarity of distant spread are reasons for deferring early intervention and other considerations which generally play an important part in cancerology. Efforts must be directed toward local destruction of the tumor for instance by curettage simple enucleation wide excision total removal of the gland removal of local and regional lymph nodes and irradiation (roentgen and radium therapy) combined or not with surgical intervention. Each method presents advantages and disadvantages and the indications will depend on circumstances. The disadvantages are scars salivary fistula and facial paralysis. Of the 53 patients 28 (52.8 per cent) were without tumoral symptoms after periods of from 4 months to 16 years. It seems that results could be improved by more rational use of the resources of radiosurgery.

RICHARD KESSEL, M.D.

Diseases of the Salivary Glands. A. C. FURSTENBERG  
*J. Am. M. Ass.* 1948 136 1

The etiologic factors responsible for inflammations of the salivary glands are foreign bodies—particularly the calculi—injury or disease of the abdomen or pelvis and extension of infection from neighboring tissues. Injury and dehydration are also potent influences in the origin and development of infections in these structures.

Effective agents in the therapeutic armamentarium are sulfadiazine and penicillin. Hydration must be instituted and maintained. Wide incision and massive drainage are required when a circumscribed collection of pus is present.

Chronic infective granulomas are rare manifestations of disease of the salivary glands. A noncaseating form of tuberculosis is occasionally observed. The gumma perhaps is more rarely seen. Actinomycosis has responded most satisfactorily in many instances to the sulfonamide drugs and penicillin therapy.

A dysfunction of the salivary glands is occasionally the result of end organ lesions of the peripheral secretory nerves. A normal salivary flow may be produced by the administration of pilocarpine. The effect of the drug is augmented by the simultaneous ingestion of the acid forming salt ammonium chloride.

The common neoplasm of the salivary glands is the mixed tumor. The soft tumors are more prone to exhibit carcinomatous alterations than the hard, firm ones. They are devastating in their clinical behavior in that they tend to degenerate into rapidly

proliferating carcinoma. Surgical intervention which accomplishes the complete removal of the lesion is most successful. When these tumors do recur how ever they usually present frank carcinomatous alterations and further surgical efforts are futile.

JOHN E. KIRKPATRICK, M.D.

## EYE

### A Cross-Sectional View of Injuries in an Ophthalmic Practice in Eire. EUTHAN MAXWELL. *Brit J Ophth.* 1948 32 134.

The author presents a cross sectional view of injuries observed in the practice of ophthalmology in Eire extending over three-quarters of a century. The cases are discussed from the viewpoint of (1) causation (2) types of injury (3) treatment and (4) medicolegal aspects.

**Causation.** A series of 796 cases are arranged in groups according to the age of the patients. Birth injuries occurred in 4 cases. Up to the age of 6 years, injuries resulting from sharp objects such as scissors, from falls, and from missiles such as sticks, stones and broken glass, occurred in 9 per cent of the patients. The group from 7 to 16 years of age which constituted 21 per cent of the patients suffered in injuries resulting from organized and unorganized games, the national game *Hurler*, was responsible for the largest proportion of casualties of this type. It is recommended that air guns be licensed and that leaving dangerous materials such as quicklime and quicksand unguarded in the public streets or in builders' yards be considered a criminal offense. The group from 17 to 45 years of age constituted 46 per cent of the patients. Because the main industry is agriculture, metal splinters from farm implements, broken wire, nails, flying particles of stone in quarrying, road-making and repairing, thorns and branches accounted for the majority of injuries in this group. The use of protective devices for the eyes is advocated. In the group of patients from 46 to 65 years of age (20 per cent) the causes of injury were similar to those in the last age group. Wearing of the 'middle distance' correction while at work helps to reduce the incidence of injury. In the group of patients who were over 65 years of age, injury occurred mainly while gathering and chopping sticks and during stresses and strains. Prevention is an individual matter.

**Types of injury.** The following arrangement shows the order of frequency of injury: (a) penetrating wounds of the eyeball, without entry of foreign bodies (36 per cent). The majority of injuries were corneal or corneoscleral and involved the lower segment of the uvea was affected in 55 per cent and associated cataract occurred in 50 per cent of the cases. (b) Contusions of the eyeball (22.5 per cent) resulted in damage to the lens in 30.5 per cent, to the iris in 10.25 per cent, to the retina in 8.25 per cent, to the cornea in 10.5 per cent (edema, infection, erosion), to ruptures of the sclera in 9.75 per cent and of the choroid in 8.25 per cent (with rupture of the re-

tina in 1 case resulting in hemianopia). Contusions of the optic nerve occurred in 3.5 per cent. (c) Superficial wounds (17 per cent) were mostly corneal. (d) Burns (8 per cent) 60 per cent of these were caused by lime compounds. (e) Foreign bodies which passed into or through the eyeball occurred in 5.75 per cent, in more than one-half of the 43 cases the foreign bodies had penetrated the posterior part of the eyeball, mainly in the sclera, and the lens was injured in at least 50 per cent of the cases in 10 cases the foreign body remained in the anterior part of the globe. (f) Injuries of the orbit (4.75 per cent) consisted mainly of hemorrhages or fractures. (g) Injuries affecting the cranium associated with involvement of the visual apparatus accounted for 3 per cent. (h) Cases in which trauma precipitated detachment of the retina, hysterical blindness, or glaucoma accounted for 4.25 per cent.

**Observations on treatment and long-term histories.** Prompt local and general (sulfonamides and penicillin) treatment is the primary consideration in eye injuries.

Results of treatment of lenticular affections were more satisfactory in cases in which every effort was made to combat a rise of tension and irritability of the iris and in which operation was deferred until a later date.

There were 43 cases of penetrating foreign bodies. In 7 of the patients the foreign body had passed through the globe, in 3 the eyes had to be enucleated, 3 patients had very reduced vision, and the seventh patient had practically normal vision.

Of the 6 cases in which the foreign body had lodged in the anterior segment, magnet or forceps extraction yielded satisfactory results in 8 cases. Of 25 cases in which the foreign body had lodged in the posterior segment, ultimate enucleation of 16 eyes was necessary. The posterior route of extraction is considered best.

There were 7 cases of sympathetic ophthalmia. These represented about 2 per cent of all penetrating wounds and ruptures of the globe. The average time of development after injury was 7 weeks.

There were 2 cases of cecropia blindness and ulceration of the cornea following a splash of tar (creosol).

An analysis of 9 cases of optic nerve involvement revealed reduction of vision in 6 instances. There were 3 cases of subdural hematoma. In the author's series and all 3 patients were subsequently operated upon.

**Medicolegal aspects of industrial injuries.** A variety of problems, including malingerers, present themselves and must be considered.

JOSEPH ZUCKERMAN, M.D.

### Peripheral Positional Nystagmus. P. G. GRILLON. *J. Lar. Otol. Lond.*, 1948, 6: 47.

Peripheral positional nystagmus is defined as a spontaneous nystagmus, not constantly present, but appearing when the head takes a special position in space. It is frequently found in disease of the cen-

tral nervous system especially the posterior cranial fossa (tumors of the brain etc.) Many cases have been described in which the nystagmus was caused by the peripheral labyrinth peripheral positional nystagmus

In the author's experimental investigations positional nystagmus is divided into two groups (1) central positional nystagmus and (2) peripheral positional nystagmus

**Central positional nystagmus** In rabbits poisoned with alcohol the nystagmus was dependent on the position of the head in space, it developed in both lateral positions and continued as long as the position of the head remained the same. It maintained a constant character the nystagmus of the upper eye with the quick component towards the nose the nystagmus of the lower eye with the quick component towards the ear

In addition to the horizontal nystagmus rotatory positional nystagmus also was observed. This nystagmus was absent after bilateral extirpation of the labyrinth

Similar experiments with quinine were conducted in rabbits. Positional nystagmus was a frequent though not a constant phenomenon.

Some investigators considered the cause as central—presumably toxic damage of the vessels of the brain. Experimentally a positional nystagmus was demonstrated even after bilateral elimination of the labyrinth and extirpation of the cerebellum. The symptom complex of Forssman is based on allergic disorders of the circulation in the vestibular nuclear region.

**Peripheral positional nystagmus** Positional nystagmus was observed after centrifugating guinea pigs when the head took a special posture. In the development of a positional nystagmus the importance of changes especially hemorrhages and inflammatory processes in the perilymphatic space was stressed

In a series of 7 cases of positional nystagmus the condition followed a radical mastoid operation in 3 cases, trauma of the labyrinth in 1 case, an acute otitis media with mastoiditis in 2 cases and acute exacerbation of chronic suppurative otitis media in 1 case. Most patients complained of giddiness sometimes with sickness and vomiting. Some patients indicated which position of the head they avoided to prevent provoking an attack of vertigo and vomiting

The author concludes that a positional nystagmus of peripheral origin does occur and is important in the diagnosis of labyrinthitis. That of most frequent occurrence was the so-called direction changing form. The importance of classifying the groups according to the classification of Nylen-Seifert is emphasized. This classification, which is given indicates which head posture develops

**Direction-changing positional nystagmus** Positional nystagmus developed especially in the lateral positions in 5 cases. (a) in both lateral positions the nystagmus beats with the quick phase to the lower

ear, (b) in both lateral positions the nystagmus beats with the quick phase to the upper ear

**Direction-decided positional nystagmus** In one case the patient developed no nystagmus when in the sitting position in dorsal position there developed right and left lateral position nystagmus—R. This type was also found by Klestadt.

**Irregular positional nystagmus** Irregular positional nystagmus did not occur in this series of patients

JOSHUA ZUCKERMAN M.D.

**The Surgical Treatment of Pterygium.** ARTHUR D OUBRAIN *Brit J Ophth.* 1948, 32 65

The author believes that pterygium is due primarily to irritation and that only secondarily is it a degenerative process. He cites the fact that hot climate and low humidity predispose to the formation of both pterygium and pinguecula. He believes also that pinguecula is a forerunner of pterygium since they appear similar under slit-lamp examination and the stroma or subconjunctival portion presents a similar histopathological picture of an extensive aggregation of fibrous tissue containing numerous elastic fibers and patches of amyloid and hyaline degeneration. When the contracting fibrous tissue becomes anchored at one end to the unyielding corneal tissue the looser conjunctival tissue becomes pulled toward the cornea and forms a pterygium.

The author bases his surgical technique on the hypothesis that the two conditions have the same etiology and the same histological and biomicroscopical appearance and differ only in their corneal involvement. If the essential portion of the pterygium is subepithelial then the surgical treatment must aim at the removal of the active connective tissue core and not at just transplantation of the pterygium to prevent its recurrence

The following operation to remove the offending connective tissue is described. A horizontal incision is made in the bulbar conjunctiva above the upper border and below the lower border of the pterygium for a distance of 5 mm. nasal from the limbus. The closed scissors are pushed downward through the upper incision beneath the pterygium. A small dressing forceps is then inserted in place of the scissors and is used to hold the pterygium firmly. A sharp knife is used to remove the pterygium from the cornea. A thin layer of cornea is included to be sure of removing all conjunctival tissue and its blood vessels. The apex of the pterygium is held up vertically and the whole subconjunctival portion of the pterygium as far medially as the plica semilunaris is dissected from the inner surface of the epithelial layer. The author believes that this is the real pterygium and that it should be completely removed. The free edge of the conjunctiva is trimmed enough to leave a bare strip of sclera several millimeters in width nasal to the limbus. This area becomes covered with conjunctiva but not until after the cornea has had time to heal. With the use of this surgical technique there have been no recurrences over a 7 year period

ROGER H. JOHNSON M.D.



Lid Repair and Reconstruction SIDNEY A. FOX  
*Am J Ophth.* 948, 311-317

Displacement of the canthi is not of common occurrence. Usually there are complications because trauma causing the condition is extensive and severe, the eye being lost.

Three cases are reported. In case 1 there is an empty socket with severe ectroblepharon lagophthalmos dislocation of the lateral canthus upward to an angle of 45 degrees. In case 2 a vertical scar runs across the forehead displacing the medial canthus downward, and in addition creating a ectroblepharon epicanthus the socket is also empty. In case 3 there is a wide linear scar running through the medial canthus which is displaced downward 8 mm.

The same principles of repair are applied in all cases. The canthal ligaments, or their equivalents are thoroughly mobilized and reattached to their natural anatomic points of insertion. When the medial canthal ligament is displaced, it is usually necessary to sever the attachment of the lateral canthal ligament (Wheeler). Another principle governing the technique of repair is that of making a Z incision two arms of which include the displaced canthus. The transposition of the flaps gives a double advantage: firstly it prevents the danger of healing scar tissue pull displacing the canthus again and secondly it supplies skin tissue where it is most needed from adjacent sites. The residual epicanthus in case 3 is corrected by means of a double Z plasty (Blair).

The importance of the points of attachment of the canthal ligaments is stressed. The lateral canthal ligament inserts into the orbital tubercle on the zygomatic bone which is behind the lateral palpebral raphe of the orbicularis, lying deeper than the medial ligament, and does not form a prominence as does the latter. The medial palpebral ligament attaches to the frontal process of the maxilla beyond the anterior lacrimal crest and forms a prominence which is normally easily palpable. Despite this, the attachment is deeper than one would suppose. This is important, especially when the canuncle has been preserved for unless the canthus is replaced in its original position at the lacrimal crest the canuncle and the semilunar folds are hidden and the optimum cosmetic result has not been obtained. In the repair procedure, all fibrous tissue must be resected to reduce as much as possible the displacement by scar tissue contraction. The ligament must also be firmly anchored in place. MICHAEL LOUWALLAH, M.D.

Statistical Study of Retinal Detachment CARL H. BACLEY *Am. J. Ophth.* 948, 3 85

The material on which the present survey is based consists of 304 consecutive cases of retinal detachment in patients operated upon in the Wilmer Ophthalmological Institute during the period between 1927 and 1944. There were 246 phakic and 58 aphakic eyes. Sixty-eight patients had detachments of at least three quadrants and 25 had detachment of the entire retina. 53 patients had detach-

ment occurred more than 6 months before operation. The majority of patients were between the ages of 40 and 60 years. Approximately 40 per cent of the phakic detachments were myopic, but myopia was not a significant factor in aphakic separations. Degenerative changes in the vitreous are a more important factor in phakic than in aphakic eyes (45 per cent versus 20 per cent). After cataract extraction, the onset of detachment was longer than 6 months after operation in 55 per cent of the patients, and longer than 2 years in 36 per cent. Trauma is somewhat more common in aphakic than in phakic eyes. Retinal perforations in aphakics were observed less frequently than in phakics and lead to the view that degenerative changes in the retina precede retinal perforations and subsequent detachments.

The discouraging prognosis of detachments associated with uveitis and glial bands in the vitreous is well known. However 5 per cent of the phakic and 1 per cent of the aphakic eyes had a positive aqueous ray at the time of operation. The preoperative clinical findings determining favorable and unfavorable prognosis, follow.

1. The prognosis was poorer after the age of 60 in phakics.

2. Increasing myopia was directly related to the poorer operative results.

3. Thirty five per cent of the detachments in aphakics were mechanically successful after operation as compared to 51 per cent in phakic eyes.

4. When present in aphakic eyes, persistent vitreous opacities have a detrimental effect. To 16 per cent successful reattachment when no vitreous was lost at the time of operation are opposed the 37 per cent of reattachments, when no vitreous loss occurred by the aphakic eyes.

5. In the presence of positive aqueous ray in phakic eyes there have been 11 failures in 25 operations.

6. The duration of the detachment before operation vitally affects the prognosis. In aphakics, after 3 months only 1 reattachment followed 11 attempts, against 37 per cent of successes if operation was performed within months of the onset of the detachment. Delays in phakics are apparently of less concern except for the danger of involvement of more or less extensive areas.

7. In the phakic cases it makes little difference in the eventual result whether the detachment is in the upper or the lower half but in all 7 cases with detachments nasally the results were unsuccessful. However an operative success of 24 per cent was obtained in complete detachment necessarily including the nasal half. In aphakics there was no difference in operative results between temporal and nasal detachments.

8. Operative results were significantly poorer when no retinal perforation was found. The location of the perforation had no effect on the operative result.

9. There has been 50 per cent operative success in patients in whom the preoperative tension was 29 mm. Hg (Schiotz) or over.

10 The present series shows no difference in retinal elevation at the time of operation. It is concluded that a wide gap between the retina and choroid is no insuperable barrier to success.

The author compares and evaluates the results of various operative techniques. In the course of years gratifying improvement has been made in operations for retinal detachment. As a result of the increasing success many operations are advised now that would not have been recommended in the rather recent past. With the beginning of penetrating diathermy success rises sharply for both phakics and aphakics. A 60 per cent success following the first operation was shown in 5 straight thermophore operations, while a successful result occurred after a second operation in 1 case, raising the success rate to 80 per cent. The amount of subretinal fluid obtained at operation has little effect on final reattachment. When diathermy punctures were made both before and after the escape of subretinal fluid the effect was about the same as when the punctures were performed only before the escape. In detachments of comparable size equally successful results were obtained when extensive areas were coagulated and when coagulation was limited to the area around the hole or one quadrant. When three quadrants were detached the best mechanical results were obtained when the area of coagulation was relatively limited. The position of the retina following evacuation of subretinal fluid was found to be of utmost importance in determining final reattachment. In 166 phakic cases in which the retina was found flat or only slightly elevated at the end of operation successful reattachment occurred in 60 per cent. However in 72 cases in which the retina remained greatly elevated at the end of operation successful results were obtained eventually in only 20 per cent. In 37 cases of aphakia in which the retina was flat or only slightly elevated at the end of operation successful results were obtained in 43 per cent, whereas in 16 aphakics with greatly elevated retina at end of operation success was obtained in only 6 per cent. The importance of leaving the retina relatively flat at the end of operation has been emphasized. In many cases revealing persistence of marked elevation of the retina after the evacuation of subretinal fluid saline has been injected into the anterior chamber or vitreous of aphakic eyes. In phakics in which the retina failed to fall back properly after the withdrawal of subretinal fluid the injection of saline through the attached portion resulted in success (46.7 per cent) an improvement but not a significant difference from those cases in which the retina was allowed to remain elevated. Injection of saline through a quadrant in which the retina was detached gave poor results (only 1 cure in 11 attempts). The intraocular injection of saline by any route in aphakics resulted in significant improvement over those in which the retina remained greatly elevated at the close of operation. No serious complication followed the intraocular injection for example infection, cataract, hemorrhage or persistent vitreous opacities.

The retinas of about 41 per cent of phakic detachments were successfully reattached on the first attempt. Of the 145 failures less than half of the patients had second operations with success in 26.4 per cent. This shows that one failure is by no means final and offers a strong incentive to reoperate. For phakics the incentive exists for even as many as 5 operations. Reoperations have raised the final percentage of success to 50.3 per cent. In aphakia only one operation after failure is advised.

MICHEL LOUFTALLAH, M.D.

**Saline Injections in Retinal Detachment** EDWIN G. GRAYSON, JR. and JACK S. GUYTON, *Am. J. Ophth.* 1948, 31: 299

The early injections of saline into the vitreous cavity given with the thought of forcing the retina back against the choroid were usually doomed to failure because the retinal holes were not sealed. In the modern surgical treatment of retinal detachments it is well recognized that not only an artificial choroid must be created to close the retinal holes but that retinal fluid must be drawn through openings in the sclera if a high percentage of reattachments is to be attained. These openings are most frequently made by means of diathermy puncture or trephine and should remain patent a number of days. The postoperative physiologic formation of aqueous usually counted upon to fill the vitreous cavity, displacing the subretinal fluid and forcing the retina back into contact with the choroid. In eyes with high elevation of the retina and slow formation of aqueous the scleral openings may close before the desired result is obtained or else the areas of artificial choroiditis are no longer active enough to close the retinal holes by the time the retina arrives in contact with the choroid. In such cases it is now common practice either to remove subretinal fluid at the time of operation or to inject air into the vitreous cavity in order to force the retina back at the time of operation.

In tables showing the percentages of reattachments in cases in which operations were performed with or without injection of saline into the vitreous the results appear approximately the same. However these figures can be quite misleading as those eyes receiving saline injections were those with much the poorer prognosis for reattachment—and the finding of equal results in groups with or without saline would indicate that the injections were of real value. Saline injections into the vitreous were performed only in those eyes in which the retina was still markedly elevated after diathermy and adequate openings had been made between the subretinal space and the outside of the sclera.

The technique of saline injection in an aphakic eye is performed by making a tiny slanting opening through the cornea at the limbus with a Ziegler knife introducing a 27 gauge hypodermic needle with an attached syringe filled with normal saline solution through the tract made by the knife and injecting saline into the anterior chamber.

For injections into phakic eyes, a 27 gauge needle with attached syringe filled with saline is inserted through the conjunctiva, sclera and pars plana of the ciliary body in whichever quadrant the retina is most elevated. As the needle is inserted diathermy current is passed through it. The needle is inserted in such a direction that the point slants backward from the lens. Saline is then injected directly into the vitreous cavity. The injection is slow and forces the subretinal fluid out through the scleral punctures and the retina back into place in contact with the choroid. A sufficient amount is injected to flatten the retina as completely as possible.

Saline injections do not produce inflammation. A disruption of the vitreous is obtained but all eyes with marked retinal separation have already an extensive disorganization of the vitreous. Saline is preferred to 'vitreous' from other eyes, as it will not produce undesirable opacities. Saline is, also preferred to air as it does not hinder ophthalmoscopic examination. MICHAEL LOUVALIAN, M.D.

### EAR

"Permanent" Deafness Due to Gunfire G. REM.  
*J. Laryngol. Otol.* Lond. 1948 6 76.

Audiometric and clinical studies were made of 16 artillerymen who had no evidence or history of ruptured tympanic membranes or middle ear disease. The mean average hearing loss of the group was 10.2 decibels. 20 per cent of the men had an average loss (512 to 8192) of greater than 30 decibels and 8 per cent had average losses of greater than 30 decibels through the speech range. Fifty per cent of the men had peak losses of greater than 30 decibels in the worse ear. Most of the damage occurred in the first or second year of service. Among the various types of audiometric curves was every gradation from an abrupt to a gradual type of high tone loss. The shapes of the hearing curves in early temporary traumatic deafness were also variable and differed in no way from those in cases of permanent deafness.

No evidence was found that "abrupt" loss characterizes deafness following a single severe detonation. JOHN R. LINDRAY M.D.

Foreign Body in the Eustachian Tube. Report of a Case ROBERT C. McNAUGHT *Laryngoscope* 1948, 58 67

The author presents the case of a welder who suffered intense pain and sudden deafness when a spark flew into his left ear. At the first aid clinic the ear was ill-advisedly syringed with water. Purulent drainage followed. Four months later roentgen examination revealed a small metallic foreign body in the tympanic part of the eustachian tube. The piece of slag was removed by catheter inflation of the eustachian tube. Purulent drainage stopped immediately and the perforation of the tympanic membrane was much smaller when last seen one month later. JOHN R. LINDRAY M.D.

Some Experiences in the Surgery of Labyrinthitis. PHILIP READING. *Guy Hosp Rep Lond* 1947 96 73.

Of 51 cases of labyrinthitis complicating mastoiditis, cholesteatoma was found to be present in 40. In most of the cases the portal of entry was found to be through a fistula in the horizontal semicircular canal. Erosion of the facial canal was seen in 39 of these cases and facial paralysis was present in 12.

Six cases were encountered in which there had occurred "silent death of the labyrinth." In these cases there was no history of deafness although labyrinth function was completely gone. The final destruction of the labyrinth may have followed a low grade, insidious serous labyrinthitis. Destruction may be so slow in these cases that the vestibular nuclei have ample time to adjust the body's posture and balance. It is possible therefore, for a latent diffuse suppurative labyrinthitis to be present in a patient in the absence of vertigo. Labyrinthotomy has been considered indicated to supplement radical mastoidectomy in these cases in order to prevent an occasional death from postoperative meningitis. Careful evaluation of labyrinth function must be done before surgery is performed even though there are no symptoms of labyrinthitis.

Of 56 patients with labyrinthitis, 13 developed meningitis, 13 developed brain abscess, and 4 had lateral sinus thrombosis. Eleven of the patients with labyrinthitis and meningitis recovered following mastoidectomy, labyrinthotomy, and transabyrinthine drainage of cerebrospinal fluid through the internal auditory meatus. All patients were treated before penicillin was available in adequate amounts. The effect of therapy with sulfonamides and antibiotics may alter indications for surgery of the labyrinth.

Labyrinthitis not infrequently may cause cerebellar or temporosphenoidal brain abscess.

Four pertinent case histories are presented.

JOHN R. LINDRAY M.D.

### NOSE AND SINUSES

Plastic Repair of the Obstructing Nasal Septum. SAMUEL FORDON JOSEPH O. GILBERT A. GILBERT SILVER, and VITO ROYCE SYRACUSE. *Arch. Otolaryngol.* 1948 47 7

The original method of correcting septal deviation was accomplished by orthopedic readjustment, and heavy instruments were used to fracture both the bony and cartilaginous septum. This method was not successful in holding the septal cartilages in place and the operation devised by Killian in 1899 became the one of choice by most rhinologists. This operation however has several weaknesses, such as the belief that removal of the anterior and inferior portion of the septum causes saddle nose deformity.

The authors believe that the septum does not offer support to the nasal pyramid but acts only as a reserve factor. It follows then that saddling of the dorsum and distortion of the tip subsequent to a too generous resection of the septum result only from

tensions developing from the cicatricial pull of the deskeletonized septal membranes—not from lack of support. Therefore any part of the septum may be removed without fear of subsequent deformity provided precautions are taken to neutralize these traction forces.

With these concepts in mind in the Fomon technique for the correction of septal deformities the septum is transfixed, and the cartilage is freed from the mucoperichondrial membrane and removed. In the meantime a bed has been created in the columella and a portion of cartilage inserted into and held firmly in, this bed by sutures.

The Galloway operation is described as being applicable only to the most caudal displacements of the septum. With this technique the septum is not transfixed but the membranous septum is cut throughout its extent on the right side followed by elevation of the mucoperichondrium on each side and the septal cartilage is removed with scissors or a swivel knife. The columella is corrected in much the same way that correction would be accomplished by the Fomon technique.

In septal obstructions associated with external nasal deformity satisfactory results depend upon the sequence of the operative steps as well as on the care with which each step is carried out.

JOHN F. DELPIT, M.D.

#### PHARYNX

Juvenile Nasopharyngeal Angiofibroma HAYES  
MARTIN HARRY E. EISENICH, and JULIE C. ABELS.  
Ann Surg., 1948 127 513.

All 29 cases of juvenile nasopharyngeal angiofibroma observed by the authors during a period of twenty years occurred in pubescent males. Reports in the literature of the occurrence of this tumor in young children, adults, or females are very likely mistaken diagnoses. The selectivity for males and spontaneous regression with the appearance of full sexual development strongly imply a sex-endocrine relationship for this tumor. In the tumors of younger subjects angiomatous elements predominate but as sexual maturity is approached the fibrous tissue stroma replaces to a large degree the vascular elements. In normal individuals mucous membrane hyperemia is known to result from estrogen stimulation. The hypothesis is advanced that this tumor may result from estrogen stimulation of the vascular tissue of the nasopharynx in young males having a hormonal imbalance. Over one half of the cases presented evidence of under-development of secondary sexual characteristics.

The initial symptom is nasal obstruction. Repeated nasal hemorrhages usually occur. Facial deformity results from large nasopharyngeal fibromas.

The tumor is anatomically and clinically benign regresses spontaneously with sexual maturity and causes no further trouble. The real hazards result from the complications of hemorrhage, sepsis, facial deformity and the effects of overaggressive attempts

at complete eradication by surgery or radiation. Treatment consists only of control of the tumor until regression takes place.

Severe epistaxis is best controlled by ligation of both external carotid arteries. Prolonged nasal packing results in ulceration and sepsis.

Sex hormone (testosterone propionate) therapy was used in several cases with gradual elimination of the tendency to bleed however regression of the tumors was not noted. In 2 cases puberty was hastened by the use of androgens and in these cases roentgen irradiation appeared to induce a more ready regression of the tumor. Roentgen therapy is indicated in bleeding nasopharyngeal fibroma. These tumors are moderately radiosensitive. Radium therapy has its place as supplemental treatment to roentgen irradiation and following surgery. Twenty years ago 2 patients were given a huge dose of interstitial radiation which was followed by osteonecrosis of the sphenoid bone, brain abscess, and death.

Large tumors with marked facial deformity and progressive destruction of the maxilla and other adjacent bony structures by pressure necrosis should be partially removed surgically. A transmaxillary approach may be used. Complete removal is impossible.

Several methods of treatment should be combined as a rule.

An analysis of data indicates that smaller doses of interstitial and roentgen radiation will effectively control symptoms if the patient is receiving continued and adequate endocrine therapy.

JOHN R. LINDSAY, M.D.

#### NECK

Tuberculous Cervical Adenitis. HAMILTON BAILEY  
Lancet Lond., 1948, 1 313.

This is a report of 20 years' experience with cervical tuberculosis encompassing from 1,300 to 1,500 operations. The author points out that the therapeutic pendulum has swung from conservative measures to surgical intervention to x-ray therapy and heliotherapy and now back again to surgical measures.

Cervical tuberculous adenitis progresses through four stages if not halted by surgical intervention. Stage 1—breakdown of tuberculous lymph node with the pus limited by the fibrous capsule of the node or nodes. Stage 2—in many cases in due course the envelope bursts and the pus comes to occupy that confined space limited by the deep cervical fascia. Stage 3—after weeks or months the dense deep cervical fascia becomes eroded and the pus swells into the commodious compartment beneath the yielding superficial fascia. This forms a collar button abscess, which at times may have a long stem. Stage 4—the superficial abscess steadily enlarges until the skin over it becomes inflamed. The abscess bursts and a draining sinus results.

Bailey does not favor the aspiration of these abscesses as advocated by Calot as this gives good

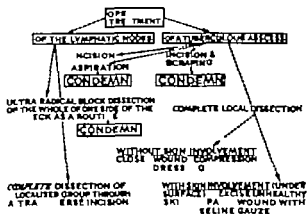


Fig. (Bailey). Scheme of general principles of operative treatment of tuberculous cervical adenitis.

results only when the patient is under constant supervision and the improvement is depressingly slow. In the past 8 years he has had 300 cases, so treated referred to him because of failure of this treatment.

Nor does he favor curettage. It is not only inefficient, but dangerous surgery to scoop down blindly in a fistula in the neck where it is filled with large vessels. Such a procedure is the antithesis of the highest attainment of surgery which is to aid Nature.

The operative technique will be influenced by the group of nodes involved and the presence or absence of skin involvement. Knowledge of the anatomical grouping of the cervical glands is a prerequisite of surgery which must be directed only at those involved.

The author believes that tonsils, adenoids, and carious teeth are the main portals of entry by which the tubercle bacilli enter the cervical lymphatic system. Therefore tonsils and adenoids should be removed and necessary dental care undertaken. Tonsils and adenoids should be removed after neck surgery as secondary involvement from pyogenic infection makes the cervical surgery more difficult.

The accompanying diagram gives the broad outline of Bailey's views drawn from his experience with tuberculous cervical adenitis.

EDMUND R. DOROGOTZ, M.D.

#### Complementary Extirpation of Lymph Glands.

Critical Study Indications, and Technique (Os ensalamentos ganglionares complementares. Estudo critico indicacoes técnicas) ALVARO RODRIGUES. *Arg. pat.*, 943, 14, 7.

At a time when the primary cancer of the lip was still curable metastases in the lymph glands of the neck were found by the author in 20 per cent of his cases while of his patients with cancer of the tongue which was still curable 65 per cent presented metastases in the lymph glands of the neck. The greater frequency and precocity of invasion of the lymph glands in cancer of the tongue is due to the structure and mobility of the affected organ which

accelerate the lymph flow. This fact has been demonstrated by the author by animal experimentation.

The author studied the topography of the lymph glands most frequently invaded by the cancer originating in the lips or the tongue, in specimens removed en bloc. Histopathologic studies showed that with the exception of a few instances with retrograde or contralateral metastases the most frequently affected glands were the submandibular and submental. An invasion of the jugular or spinal lymph glands was never observed in cancer of the lip.

In lesions of the anterior and middle third of the tongue, chiefly the submental and submandibular and less frequently the jugular glands were invaded. In lesions of the posterior third of the tongue the author was able to establish the integrity of the submental glands, but occasionally he found invasion of the submandibular glands, while the jugular glands were invaded in each instance. The spinal chain and the retrosternal glands were sometimes invaded. Lesions of the anterior third and less frequently those of the middle third strictly confined to one side, may produce bilateral metastases. As a rule lesions of the posterior third of the tongue confined to one side produced metastases only on the corresponding side.

Carcinomatous cells in the lymph glands are very radioresistant and therefore an implantation of radium needles is preferable to x-ray treatment. However good results may be expected only if metastases are confined to irradiated glands. It is evident that such glands cannot be easily identified before the application of radium. X-rays have only a sclerosing effect on metastases in the neck. Generally speaking surgery is the method of choice in the treatment of metastases in the neck, except in cases in which the primary lesion is located in the palate or belongs to special types, such as lymphoepithelioma or cancer of the intermediate type. A surgical intervention is contraindicated only in the presence of insurmountable technical difficulties.

In cancer of the lip a dissection of the lymph glands should be undertaken only if they are palpable and suspicious. On the other hand, in cancer of the lip unless the lesion is very limited and detected in the early stages a prophylactic dissection of the glands is always indicated.

Dissection should not be undertaken until extirpation of the primary lesion has been accomplished because in the majority of cases a glandular recurrence is the consequence of the recurrence of the primary lesion.

The author describes a technique which allows a nearly complete removal of the chain of the lymph glands of the neck with preservation of the spinal nerve and the sternocleidomastoid muscle. The common or internal carotid artery and the pneumogastric nerve must have to be ligated. Two incisions are made: one parallel to the lower jaw on the involved side and the other extending from the mastoid process to the clavicle parallel to the sternocleidomastoid.

mastoid muscle. Contrary to the opinion of several American writers, the author advocates the resection of the anterior belly of the digastric muscle.

JOSEPH K. NARAT, M.D.

**Carotid Body Tumors.** WILLIAM S. MACCOMB, *Ann Surg* 1948 127 269

Carotid body tumors are rarely seen on the surgical services of most hospitals. A survey of the literature reveals reports of nearly 300 tumors of this type since the first case was reported in 1903.

The exact function of the carotid body is still not definitely established. The most recent thought is that they contain chemoreceptors which respond to chemical changes in the blood. The 1941 report of the Mayo Clinic indicates that the function, whatever it may be, is negligible since both carotid bodies can be enucleated without any manifest symptoms.

Carotid body tumors occur most frequently in the third and fourth decades of life with no predominance in either sex.

The usual symptoms are a mass or lump in the neck which has often been present for several years or the presence of a pharyngeal mass. The patient frequently presents himself because of a noted increase in the size of the mass. Involvement of the vagus nerve, cervical sympathetic chain or hypoglossal nerve has been observed.

The diagnosis of carotid body tumors is difficult. Tumors of this type are rare, but must be considered. The authors recommend aspiration biopsy.

Most authors agree that carotid body tumors should be removed surgically, yet the necessity for ligation of the common and internal carotid arteries occurs so frequently that were it possible to be certain of the benign nature of the tumor, it might be better to refrain from this procedure, because of the high postoperative mortality. The possibility of a benign tumor later becoming malignant must be kept in mind, however.

Mortality rates for surgical excision of carotid body tumors with ligation of the common and internal carotid arteries, are reported from 0 to 100 per cent. Such results demand careful consideration before an operation is undertaken which may require resection of the carotid arteries. Postoperative disabilities are estimated to be as high as 83 per cent. They consist of temporary or permanent hemiplegia and the effects of injuries to the cervical sympathetic, hypoglossal or vagus nerves.

In the author's series of 10 cases the carotid body tumor was resected without injury to the arteries in only 3 instances. In the other 7 cases it was necessary to include the carotid arteries in the resection of the tumor. There were 4 postoperative deaths. Hemiplegia preceded death in each instance. The postoperative mortality rate for the 7 patients requiring removal of the carotid arteries was 58 per cent. The mortality rate for the total group of 10 patients was 40 per cent.

Fatalities following carotid ligations are usually the result of insufficient collateral cerebral circula-

tion or an ascending thrombosis of the internal carotid artery. In the former hemiplegia occurs immediately and in the latter from 30 to 36 hours postoperatively.

The Matas test should be utilized to determine the collateral cerebral circulation and if necessary a partial occlusion should precede total occlusion and removal of the tumor.

Ascending thrombosis possibly can be prevented by ligating over a strip of fascia to prevent internal damage, and by the use of heparin postoperatively.

It is difficult to get adequate biopsy material to enable the pathologist to determine whether or not the tumor is malignant. If one could be certain that a carotid body tumor was benign it might be wise to keep the patient under observation and refrain from the use of surgery except in cases in which the increasing size of the tumor is believed to be causing symptoms of pressure.

EDMUND R. DONOGHUE, M.D.

**Gastric Acidity in Thyrotoxicosis** (*La acidimetria gástrica en la tireotoxicosis*) JUAN C. PLA, C. MUÑOZ MONTAÑANO and DANIEL MURGULA. *Arch. Med.* 1947 30 446

The gastric juices of 30 patients having various types of thyrotoxicosis were analyzed. Of these 16 showed anachlorhydria (43.3%), 9 hypochlorhydria (30%), 3 normal chlorhydria (10%) and 2 hyperchlorhydria (6.6%). It was found that when the basal metabolism was above 50 per cent, anachlorhydria was more frequently observed and was present in those who never had treatment for hyperthyroidism or had treatment for only a short time. The other conditions were seen in patients who were treated from 6 months to several years. Gastroscopic examinations were made on 9 patients—2 with normal acidity, 1 with hyperchlorhydria, 2 with hypochlorhydria, and 4 with anachlorhydria. All showed normal mucosa except one who had a superficial gastritis.

These observations led the authors to conclude that anachlorhydria of the thyrotoxic patient is purely a functional disturbance.

STEPHEN A. ZIDMAN, M.D.

**Results of Prolonged Medical Treatment of Hyperthyroidism with Thiouracil** T. S. DAKOWSKI, E. B. MAN, J. R. ELLINGTON, J. P. PETERS, and A. W. WINKLER. *Am. J. Med. Sc.*, 1948, 215 123

To determine the efficacy and advisability of prolonged medical treatment of thyroid overactivity 118 hyperthyroid patients were given thiouracil usually together with a strong solution of iodine. The authors state their patients reported subjective improvement after from 1 to 2 months of the start of thiouracil therapy. When an optimum therapeutic regimen of 75 to 210 mgm daily is employed a favorable clinical response follows with decreased metabolism levels, a cancellation of body weight losses and a disappearance of the tachycardia. The concomitant use of a strong solution of iodine en-

hances the response. The advantages and disadvantages of treatment of hyperthyroidism are discussed.

The authors conclude, from their series of 80 patients who were under treatment for from 6 months to over 2 years, that thyroid overactivity can be controlled for long periods by thiourea and iodine with a minimal incidence of toxic reactions. The authors report occasional gastrointestinal distress and in 2 patients, drug fever. In a small number of patients the hyperthyroidism seems to have disappeared. W FORSTER MONTGOMERY M.D.

Lingual Gutter EMIL GOSTER. *Ann. Surg.* 1948, 27: 291

A critical study of 3 cases of lingual gutter that came under the author's care is presented.

Previously Montgomery presented the following criteria of authenticity for such cases: (1) the examination of the specimen removed should reveal thyroid gland tissue, or in lieu of this requirement, (2) thyroid insufficiency should supervene following removal of the nodule and (3) the lesion should appear in the substance of the tongue between the epiglottis and the circumvallate papillae.

At least 90 per cent of patients with lingual gutter suffer from symptoms of pressure and obstruction such as dysphagia, dysphonia, and dyspnea. Less frequently reported symptoms are fullness and a feeling of tightness in the throat. Authoritative instances of hyperthyroidism have not been reported in cases of lingual thyroid. Pain is uncommon. Thyroid insufficiency has been reported in about 15 per cent of the cases, and the only physical characteristics seen are those associated with thyroid insufficiency; otherwise these patients are singularly free from associated developmental anomalies.

These tumors vary in size from that of a pea to the size of an orange. They are usually globular, the surface smooth or somewhat lobulated, the color red to dark red. Surface vessels usually indicate a fair degree of vascularity. The lesions are usually median in position, at or immediately posterior to, the foramen cecum and are attached by a broad base. Some are superficial, others penetrate into the deep substance of the tongue. The tumors reported resemble, in many ways, the appearances often seen in cervical adenomatous goiter. However the majority resemble more nearly the normal thyroid tissue. Carcinoma has been reported, but is uncommon and has never been reported in a female patient. Many of these show the microscopic picture of the fetal adenoma and thus are capable of producing multiple types of epithelial overgrowth, suggestive of malignancy. This has made it difficult for the pathologist to make a final diagnosis on a biopsy per se. The clinical course and involvement of regional nodes must be considered for a final opinion.

Surgery has been resorted to because the symptoms are mainly those of laryngeal and pharyngeal obstruction. The tongue is withdrawn by traction sutures and the mass raised with a finger in the pharynx. Transfixion sutures are placed before an elliptical incision is made, which leaves a little thyroid tissue on either side and the posterior pole. The transfixion sutures are tied to control hemorrhage and additional sutures are placed as required. Some thyroid tissue must be left as two-thirds to three-fourths of these patients may be without thyroid tissue in the normal location in the neck. If hypothyroidism persists or develops, it is controlled with thyroid extract.

A review of the pertinent literature has also been given. EDWARD R. DOMBOUY, M.D.

# SURGERY OF THE NERVOUS SYSTEM

## BRAIN AND ITS COVERINGS; CRANIAL NERVES

**Experimental Observations in the Treatment of Craniosynostosis.** FRANK D. INGRAHAM, DONALD C. MATSON, and EDEY ALEXANDER, JR. *Surgery* 1948 23 252

In craniosynostosis there is a premature sealing of the cranial sutures causing mechanical compression of the brain with limitation of its growth and subsequent neurological dysfunction. It is believed that the current surgical measures used to combat this condition are in general, unsatisfactory in the first months of life because of the rigid reformation and fusing of bones after the operative procedure. The authors have endeavored to devise a method of producing and maintaining artificial channels in distribution similar to the normal sutures which have prematurely fused.

Experiments were carried out on 11 dogs and 16 monkeys to study the reaction of inert foreign substances placed in channels of the cranial bones. Burr holes were made in the frontal and posterior parietal regions bilaterally about 1.5 cm. from the midline. These were then joined on either side by the Gigli saw and trimmed with a chisel so that a 2 mm. gap remained on both sides for a distance of 2.5 to 3 cm. Drill holes were made about 3 mm. from the edge of the saw cut so that 4-0 silk sutures could be passed through the cranium and the experimental substance held in position. The various materials were interposed on the right side, the left served as a control.

Specimens were studied at intervals of 32 to 315 days and the gross appearance of the foreign material, the bone, the scalp, and the underlying dura was observed. Histological studies were made of cross sections of saw cuts containing each substance and its corresponding control. When fibrin film was used bony union occurred over the material in from 6 to 7 months. With the use of oxycel the authors were able to obtain solid fibrous union which was as strong as the early bony fusion on the control side. Around the interposed tantalum there was no new bone formation, but its weight and radio-opacity are undesirable features. Bone did not form over lucite but the material was deemed unsatisfactory because of its rigidity and brittleness. Polyethylene exhibited the most desirable experimental results. It is well tolerated by the tissues and can be procured as hollow flexible tubing which is the form in which it was employed here. There was no new bone formation and flexibility of the tubing persisted even after it was embedded in tissue for over 9 months.

The authors have included numerous excellent illustrations to demonstrate their findings. Clinically they have used polyethylene successfully in 6 infants suffering from craniosynostosis.

RICHARD C. SCHNEIDER, M.D.

**Cerebral Arteriography.** I. S. WECHSLER and S. W. GROSS. *J. Am. M. Ass.*, 1948 136 517

The authors stress the fact that ruptured aneurysms are not the only cause of subarachnoid hemorrhage. They report 10 cases in which arteriography was performed in the acute or subacute phase after hemorrhage. In 6 cases vascular malformations were demonstrated and in only 4 cases were aneurysms present. No serious complications were incurred as a result of arteriography. Because it is not radioactive and is readily excreted from the body, diodrast was used in preference to thorocontrast for the injections.

From their experience the authors believe that recurrent subarachnoid hemorrhages which do recover are more apt to arise from vascular malformations than from aneurysms. Death is likely to occur from leakage of aneurysms during the first or second attack unless ligation of the vessel is carried out. In this series ligation of the common carotid artery on the same side as the lesion was performed in 7 cases, 4 patients having vascular anomalies and 3 having aneurysms. There were 2 fatalities after ligation of vessels for aneurysmal bleeding; the procedure had been performed intracranially in one case and in the other the common carotid artery was ligated in the neck. Both patients were regarded as being practically moribund and the authors believed they would have died anyway.

It is deemed safer to ligate the common carotid than the internal carotid artery. If the former is done no gradual compression of the vessel is necessary; the circulation is only reduced about 50 per cent, and the complications of convulsions and hemiplegias are diminished. In one case of aneurysm the vessel was ligated intracranially and on another patient with a vascular anomaly an exploratory craniotomy was performed. Radiation therapy was used in 2 cases with vascular malformations. The authors are of the opinion that intracranial exploration usually has very little to offer in vascular anomalies and that either carotid ligation or radiation is the treatment of choice. Recurrences have not been seen in patients who have had the carotid artery ligated for vascular abnormalities, but in 2 of these patients the procedure has been performed rather recently.

The authors now feel that arteriography is simple and safe and they do not hesitate to carry out the procedure in the very acute phases of the hemorrhage so that early adequate therapy may be instituted.

RICHARD C. SCHNEIDER, M.D.

**Herniation of the Cerebral Ventricles.** CHARLES R. PERMYN and EUGENE P. PENDERGRASS. *Am. J. Roentgen.*, 1948, 59 27

Spinal fluid block is likely to produce dilatation of the third, fourth and lateral cerebral ventricles.



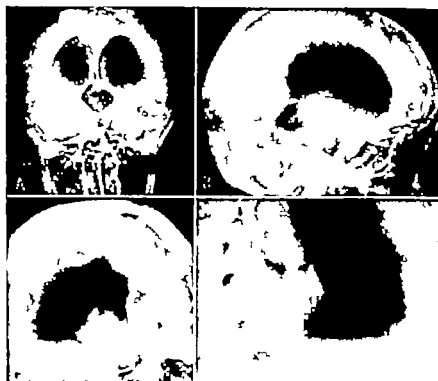


Fig. (Perryman, Pendergrass) Herniation of cerebral vent.

With the exception of anterior dilatation of the third ventricle, the herniation takes place between the incisura of the tentorium and the brain stem. For correct clinical diagnosis, it is necessary to recognize and differentiate these three varieties: (1) herniation backward of the third ventricle; (2) herniation upward of the fourth ventricle; and (3) herniation downward and medially of the lateral ventricles.

Five cases of posterior herniation of the third ventricle, 3 cases of herniation of the lateral ventricles, and 1 case of upward herniation of the fourth ventricle observed at the University Hospital of Pennsylvania were studied. The ventricles and their various recesses, with reference to normal contours seen in air studies are illustrated. The 5 cases of herniation backward of the third ventricle are described with appropriate case histories and plates. This type of herniation may occur when the cerebrospinal fluid pathway is in the fourth ventricle or aqueduct of Sylvius. This usually occurs downward under the tentorium and, when advanced gives rise to a characteristic square sign (Fig. 1).

Some of these findings were confirmed by the examination of autopsy specimens. All rarely the out-pouching of the third ventricle occurs upward over the tentorium outlining the splenium of the corpus callosum. Herniations of the third ventricle downward under the tentorium can be mistaken for herniations of the lateral ventricles if care is not exercised in examining the roentgen films. The continuity of the abnormal shadow with the third ventricle

must be established. Those of the lateral ventricle have a characteristic appearance described as "dimpling" in which the constriction of the herniation, caused by the tentorium, is clearly seen in lateral projections. This type of picture may be seen in cases in which there is an obstruction in the anterior part of the third ventricle and has been described as a subtentorial pressure diverticulum. It is not produced by lesions in the aqueduct or fourth ventricle. Obstructive conditions in the lower part of the fourth ventricle may lead to dilatation and upward herniation of the ventricle through the incisura. In these cases the continuity of the ventricles with the aqueduct can be demonstrated while in the anteroposterior views the "square sign" is not seen. The "square sign" is said to be caused by air in the herniation of the third ventricle compressed between the tentorium and the quadrigeminal plate.

It is possible that the herniations themselves cause symptoms or aggravate obstructive signs. Enucleation of herniations is suggested as a palliative method for short-circuiting the blocked cerebrospinal fluid flow.

ADAM VON BRUNNEN, M.D.

Observations upon Patients with Penetrating Wounds Involving the Cerebellum. JOHN E. WENSTER, R. C. SCHREIBER, and J. E. LOVSTROM. *A. N. Surg.* 948, 7337.

Upon analyzing 300 cases of penetrating cranial wounds observed at the Thirty-sixth General Hospital during World War II the authors found that

in 10 cases the lesions involved the cerebellum an incidence of 3 per cent. In 3 cases the wound of entrance was in the neck and the injury to the cranium was overlooked. The low incidence of survival of patients with wounds in the posterior portion of the cranium may have been responsible for the infrequency of hospitalized cerebellar wounds. The fact that the steel helmet provided more adequate covering of the cerebellum than of other parts of the brain may have been a significant point.

Adequate roentgenological studies were regarded as essential, and mentovertebral and occipitovertebral views were considered invaluable. Because of the possibility of the rapid development of serious complications in this region early unilateral cerebellar exploration under general endotracheal anesthesia should be performed, with excision of devitalized tissue and any large retained metallic fragments.

Five patients were operated upon at the Thirty-sixth General Hospital, in 4 cases the cerebellar injury had been completely overlooked. The 5 remaining patients had been operated upon at evacuation hospitals. The authors present 5 cases in some detail to indicate the various complications encountered. One patient had had an acute subdural hematoma which was successfully treated at the Thirty-eighth Evacuation Hospital. In 2 cases tears of the lateral sinus were serious complications at the primary débridement. A severe wound of the base with extensive damage to the cranial nerves and the internal carotid artery was another particularly difficult problem.

There was one death in the series of 10 cases a mortality rate of 10 per cent. In this patient tetanus complicated the problem of a cerebellar abscess. As final neurological dysfunction 3 other cases showed, respectively marked cranial nerve impairment with associated vascular injury unilateral deafness with peripheral facial palsy and marked visual impairment. The remaining 6 patients exhibited minimal neurological sequelae.

RICHARD C. SCHWIDLER, M.D.

**Medulloblastoma Cerebelli.** FRANC D. INGRAHAM  
OXFORD T. BAILEY AND WILEY F. BARKER. *N. England J. M.* 1948 338 171

Tumors of early childhood such as medulloblastoma cerebelli have been of considerable interest because of their sudden onset their poor prognosis, and their susceptibility to x ray therapy. Roentgen treatment of this condition without histological verification can be carried to dangerous extremes.

The 56 patients whose cases are discussed have been the subject of various reports by different groups of authors. The patients were seen at the Peter Bent Brigham Hospital Boston since 1930 and some had been operated on by Doctor Cushing. Seventy-two operations were performed on 53 patients with an operative mortality of 32 per cent. 3 patients were considered too ill to be operated upon.

Forty-one of the tumors were midline 10 were in the pons and cerebellopontine angle, and 5 in the cere-

bellar hemisphere. In the course of 7 of 60 explorations of the posterior fossa, a tube was led from the lateral ventricle into the posterior fossa (Torkildsen's procedure). In 10 cases distant spinal or cerebral seedings were observed and in 2 cases metastases caused paraplegia. There were 5 patients with cord bladder and 7 with severe root pains. Acute gastric ulceration was found to exist in 3 cases but in only 1 case was perforation the cause of death.

Roentgen therapy following operation is believed to be the best method of treatment, and the various dosages are set forth. A group of 15 patients received between 4,000 and 10,000 roentgens with a survival rate of 14 months. Some patients received unusually large quantities, the highest being 30,000 roentgens to the skull and spine over a period of 3½ years.

As a result of their studies the authors have made two important decisions (1) that temporization with preliminary trials of roentgenotherapy are errors of judgment for the nature of the lesion can only be presumed on a statistical basis, and a child with a benign lesion may lose his chance for surgical removal during this period. (2) that Torkildsen's procedure is indicated at any time after the primary exploration of the posterior fossa when the flow of cerebrospinal fluid becomes obstructed.

ADRIEN VAN BRUGGEN, M.D.

**Postoperative Period of Survival of Patients with Oligodendroglioma of the Brain: Report of 25 Cases.** HENRY A. SEITZ, FRANK C. GRANT AND JOHN H. DREW. *Arch. Neur. Psychiat. Chic.* 1947 58 710.

The classification of brain tumors rests on a fairly solid foundation. It is based on the histological picture and the history of the patient. From time to time readjustments are necessary in any scheme. A type of glioma known as an oligodendroglioma has long been regarded as being relatively benign and the survival period even after incomplete removal of the lesion is long—from 3 to 5 years.

The authors' study is based on 25 cases of oligodendroglioma observed at the Hospital of the University of Pennsylvania. In 6 cases the tumors were intraventricular and in 19 cases intrahemispheric. It is pointed out that these tumors infiltrate the brain and consequently it may be impossible to remove them completely. Thirteen tumors were sufficiently calcified to be seen in preoperative roentgenograms. 17 of the 19 intrahemispheric tumors were situated in one or the other or in both of the frontal lobes. The average duration of symptoms was 8 months in the patients with intraventricular tumors and 35 months in those with intrahemispheric tumors. Epileptic seizures occurred in 13 of the 19 patients with intrahemispheric tumors. Seeding of the ependyma adjacent to the intraventricular tumors was noted but there was no dissemination through the cerebrospinal axis.

Five of the 6 patients with intraventricular tumors survived operation and at the end of 50 months

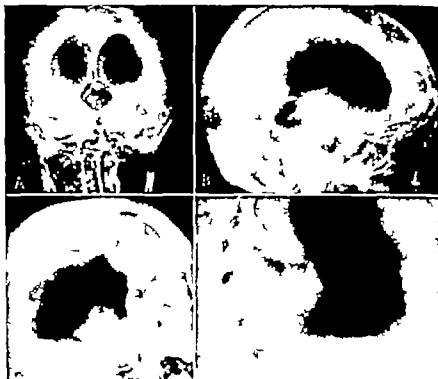


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ABRAHAM VAN BROCKHOFF, M.D.

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RICHARD C. SCHNEIDER, M.D.

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Five of the 6 patients with intraventricular tumors survived operation, and at the end of 50 months

only one is living the average survival of the whole group was less than 3 years.

The views of other authors on the subject of oligodendrogliomas are discussed.

ADRIEN VER BRUGGEN, M.D.

### SPINAL CORD AND ITS COVERINGS

**The Occurrence of Extensor Spasm in Patients with Complete Transection of the Spinal Cord.**  
MAXIM B. MACINTYRE and ROBERT A. KIRK. *N England J M* 1945, 38 31

From the Paraplegia Service, Cushing Veterans Administration Hospital Framingham, Massachusetts, a preliminary report is given on observations relating to certain patterns of involuntary activity exhibited in 27 verified cases of complete transection of the spinal cord. The duration of complete severance of the cord was 2 or more years and the levels of cord transection ranged from the second to the twelfth dorsal vertebrae.

Earlier investigators have stated that extensor spasm is a sign of an incompletely divided spinal cord. However in these 27 cases of complete division of the cord it was noted that 19 patients exhibited predominant extensor spasms in the muscles innervated below the level of the severance. Two patients showed flexor spasms alone, and 3 showed approximately equal extensor and flexor spasms.

In their experience, the most typical order of events following complete transection of the spinal cord is spinal shock gradual return of reflex activity alternating flexor and extensor spasms and finally predominant extensor spasms. In present day paraplegics, because of the longer duration of the individual's life the stage of predominant extensor spasm is more frequently observed. The authors conclude from their study that extensor spasm in skeletal muscles innervated below the level of the spinal cord transection is not conclusive proof of an incomplete division of the human spinal cord.

JOHN L. BELL, M.D.

**Skeletal Traction and Anterior Decompression in the Management of Pott's Paraplegia.** NORMAN M. DOTT. *Edinburgh M J* 1947 54 680.

In Pott's disease of the spine, exhibiting paraplegia, skeletal traction and anterior spinal decompression was used in 31 patients from 1944 to 1947. Skeletal traction is advocated as a valuable adjunct in correcting and maintaining fixation of the spine in Pott's disease with or even without paraplegia. The anterior spinal decompression operation is used to expose the internal gibbus, and it is advocated over laminectomy for the relief of spinal cord compression when a sufficient intraspinal abscess is not present.

Skeletal traction is used in combination with recumbent fixation in a plaster shell. For cervical and upper dorsal disease Blackburn tongs are applied to the skull with from 3 to 10 pounds of traction. For middorsal and lower dorsal disease, 20 to 30 pounds of traction is obtained by attaching a strong spring to

the skull tongs and transfixing the tibiae to the foot pieces of the plaster shell by pins. Marked improvement in paraparesis has been noted by the use of this method, without operative procedure, to correct the deformity. Patients are more comfortable, especially in ventral shells.

The anterior spinal decompression operation was used in 18 cases to expose the internal deformity causing the spinal cord compression. In acute, rapidly progressive paraparesis, the author considers the operation as an emergency procedure to combat the danger of acute ischemia of the spinal cord. The operation is indicated also in patients with chronic progressive paraparesis and in those in whom adequate fixation is difficult because of spasms of the paralyzed extremities.

Three deaths occurred among the 18 patients operated upon 2 of these were due to uremia in the immediate postoperative period. One patient received no benefit from the anterior spinal decompression. Two patients developed acute nephritis in the postoperative period with subsequent recovery. Twelve patients had complete spinal cord recovery and 3 had nearly complete recovery. Improvement in the general health was rapid following operation. Bony recovery is attributed to the improvement in general health and not to the operation. Bone grafting in patients who have had recovery of function of the spinal cord is left to the discretion of the orthopedic surgeon and the tuberculosis expert.

JOHN L. BELL, M.D.

### PERIPHERAL NERVES

**Tantalum Foil Cuffs in Peripheral Nerve Surgery.** EVERTON E. CLIFFTON. *Surgery* 1945, 3: 307

The new metal tantalum was developed just prior to World War II for use especially in peripheral nerve surgery. It was advocated that tissue reactions or adhesion formation would be avoided inasmuch as tantalum was an inert metal.

As time went on it became apparent as more and more nerves were re-explored that ingrowth of scar tissue into the suture line or damaged nerve was not prevented but that dense scar tissue formation occurred both outside and inside of the smooth cuff foil.

Cliffton reports a series of cases, including only those in which sufficient time has passed for adequate follow-up. In 362 neurotrophies reported, the return of function was not appreciably altered by the use or omission of the tantalum cuff however the development of paresthesias or trigger points was more prevalent in cases in which foil was used. In 16.8 per cent of 16 cases of neurolyses in which foil was used operation was done again because of the presence of a trigger point, whereas in only 2.5 per cent in which foil was not used reoperation was found necessary.

In a review of the cases in which reoperation was carried out it was certain that the nerves from which foil was removed were more scarred and damaged

and the operative procedure was more difficult than in those in which the nerve was not wrapped in foil. Wherever there were cracks in the foil there was increased scar formation. In 2 cases it was certain that at the first operation damage to the nerve was minimal when the foil was applied whereas at the second operation there was serious scarring and neuroma formation. In other cases the changes ranged from marked edema of the nerve to serious scarring moderate neuroma formation or partial constriction.

Of the cases necessitating reoperation 60 per cent in which foil was used showed improvement after the second operation and all but 2 lost their trigger points whereas only 27 per cent of those in which foil was not initially used showed improvement. This would lead one to believe that the foil in these cases was actually a harmful element.

It must be pointed out that the poor results may have been due to errors in tantalum application such as (1) cracking the foil while preparing or applying it, or (2) constricting of the nerves with sutures tied too tightly in the attempt to hold the foil in place.

If tantalum is to be used infinite care must be used in preparing and applying it. One suggested method in neurorrhaphies is to place a formed cuff over one end of the nerve up onto the trunk and then slip it back over the suture line when the suture is completed. Another method involves preparation of the cuff around a smooth round object and then snapping it in place on the nerve in order to avoid ligatures.

Clifford concludes that tantalum foil as a cuff in peripheral nerve surgery has not proved to be of value in this series of cases its routine use is not advised unless the operation is the first of a two-stage procedure in which case a pseudomembrane surrounding the foil tends to make a smooth gliding surface for the nerve at the suture line. If the time interval between stages is not to be over 2 months

GEORGE R. GRAMER, M.D.

Concerning the Surgical Treatment of Traumatic Injury to the Upper Division of the Brachial Plexus (Erb's Type) ALEXANDER LURJE. *Ann Surg* 1948 127 317

In injuries of the "upper primary fasciculus" of the brachial plexus (formed by the confluence of  $C_5$  and  $C_6$  roots) the classical treatment of choice has been resection of the neuroma with direct suture when possible. If the defect was too great to permit suture transplants were used but usually with little success. Occasionally it has been possible to employ a neurotizer that is the implantation of the peripheral end of a neighboring nerve into the distal portion of the divided upper primary fasciculus. Sometimes there was considerable difference in the dimensions of the neurotizer and the cut end of the brachial plexus or else the damage may have been so severe that the ordinary neurotizer such as the phrenic, long thoracic nerve or one of the anterior thoracic nerves could not be used.

The authors concluded that certain muscular branches of the plexus might be used as neurotizers without marked functional impairment of the extremities. This enables suture to be carried out distally from the site of trauma. The advantages and disadvantages of various nerves as neurotizers are described. The authors discuss in detail the careful observations that must be made as to the adequacy and choice of neurotizers. Clinical and electrophysiological studies of the degenerated recipient nerves must be made preoperatively. During operation stimulation with the inductorium and determination of chronicity should likewise be carried out. A nerve donor which has only a part of its fibers degenerated may show fair function in electrical testing. The degenerated recipient nerve is considerably smaller than the usual normal one therefore considerably thinner donor nerves can be sutured end-to-end to thicker recipients even if the ratio of cross section is 1 to 2 or 1 to 3.

The authors present a case of Erb's palsy in which neurotization was performed. Eight months prior to operation the patient had suffered a shrapnel wound of the left side of the neck. There was marked atrophy of the scapular deltoid and biceps muscles with complete loss of function in the shoulder joint except for adduction by contraction of the pectoralis and the latissimus dorsi. There was complete absence of flexion in the elbow with adequate extension absence of supination and absence of adequate pronation. Movements in the radiocarpal joint, wrists and fingers were preserved. There was anesthesia in the  $C_5$  and  $C_6$  dermatomes. At operation the long thoracic nerve was stimulated and contraction of the serratus muscle occurred. A portion of the nerve was divided the branches being left to the uppermost digitations of the serratus. The proximal portion was then inserted into the suprascapular nerve which had been divided below the clavicle. Two branches of the anterior thoracic nerve were identified they responded to stimulation and these were sutured to the distal end of the musculocutaneous nerve. Three ramus of the triceps were dissected out two of these were divided and turned upward to be implanted into the axillary nerve. In all anastomoses the caliber of the donor and recipient nerves were nearly equal.

Fourteen months after operation there was disappearance of atrophy of the scapular deltoid and biceps muscles. Contraction of the deltoid abducted the shoulder 55° with the patient in the supine position the deltoid could maintain the extremity in a vertical position. Flexion at the elbow was complete with use of the biceps although strength was less than that of the normal side. Contraction of the biceps had synchronous contractions with the pectoralis and when the deltoid contracted the triceps muscle likewise showed a synchronous response.

The authors regard the result as being fairly satisfactory and they advocate the procedure for similar cases.

RICHARD C. SCHWEIDER, M.D.



# SURGERY OF THE THORAX

## CHEST WALL AND BREAST

**Benign Lesions of the Breast** HARRY A. OBERHELMAN *Surg. Clin. V America* 1948, 28 95

The author studied 556 consecutive breast lesions and found 2 per cent to be inflammatory, 40 per cent malignant and 58 per cent benign. Of the 318 benign lesions, 102 were true tumors and 216 were of the chronic cystic mastitis variety. Only 15 benign true epithelial and 16 benign true connective tissue type tumors were found. The greatest number (71) were lesions of both epithelial and connective tissue type (fibroadenomas, 69 and cystosarcoma phylloides, 4). The author divided the 216 cases of chronic cystic mastitis into proliferative (182) and nonproliferative (84) types.

All of the benign tumors should be removed surgically. The author recommends the Warren incision in the thoracoanmammary groove. This incision offers the advantage of direct inspection and palpation of the breast and leaves a concealed scar. For intraductal papillomas a semicircular incision at the periphery of the areola is advisable.

A discussion is given of the various anatomic alterations that the female breast normally passes through as a result of the action of the various sex hormones present during the life cycle of the individual. It is now generally accepted that the various types of anatomic lesions in chronic cystic mastitis are the result of prolonged or repeated periods of endocrine imbalance due probably to ovarian dysfunction.

There has been much confusion in the literature in the nomenclature for chronic cystic mastitis. Also there is a uniform lack of agreement as to whether the different types of chronic cystic mastitis lesions represent different stages of the same disease or whether they are separate disease entities.

Cole and Rossiter classify chronic cystic mastitis into 4 types: (1) the adenofibrosis type—a proliferation of fibrous tissue containing scattered groups of acini, (2) the benign parenchymatous hyperplasia—consisting of proliferation of the epithelial structures of the glands and ducts, (3) the precancerous hyperplasia representing a high grade of atypical epithelial hyperplasia with mitosis and (4) cystic disease—localized cysts formed largely during the process of involution.

The author groups 1 and 4 together as the non-proliferative and groups 2 and 3 together as the proliferative types. Aspiration transillumination and palpation will usually enable one to make the correct diagnosis. If there is any question biopsy should be resorted to.

The treatment of chronic cystic mastitis may be conservative or surgical. Attempts to restore the disturbed endocrine balance by administering hormones have been unsuccessful. The author after

watching the patients' condition through at least one menstrual cycle feels that grossly palpable breast lesions in chronic cystic mastitis should be widely removed. If malignant or if the pathologist is suspicious of malignancy the surgeon should carry out a radical mastectomy.

The author cites some of the views in the literature on the subject of whether or not chronic cystic mastitis is a precancerous lesion. Numerous views in support of each side are given. The author believes, after weighing all the evidence at hand, that in a limited number of instances in the highly proliferative forms such as the adenopapilloma the lesion may for all practical purposes be considered a precancerous one and should be treated as such by radical mastectomy. ROBERT R. BIGELOW M.D.

**Gynecomastia Due to Infectious Hepatitis of the Homologous Serum Type** GERALD KLATSKIN and EMANUEL M. RAFFAPORT *Am. J. Med. Sc.* 1947, 214 121

The authors report 2 cases of bilateral gynecomastia occurring during convalescence from infectious hepatitis. The hepatitis was of the homologous serum type and ran a severe and prolonged course but there was no evidence to suggest the development of cirrhosis. The gynecomastia subsided spontaneously so that early recognition of the relationship between breast lesions and hepatitis precluded needless surgery. Hormone excretion studies in infectious hepatitis suggest that hyperestrinemia is an important factor in the pathogenesis of this type of gynecomastia.

The normal liver inactivates estrogen, but in experimental liver injury and in clinical cirrhosis this function is seriously impaired. The gynecomastia that occurs in cirrhosis is thought to be due to the resultant hyperestrinemia, but other factors may be contributory. Certainly atrophy of the testes and chronic malnutrition which are common complications of cirrhosis may play a role since both may give rise to gynecomastia in noncirrhotics.

Gynecomastia has not been reported as a complication of infectious hepatitis. Both of the authors' patients suffered unusually severe and protracted jaundice and showed low serum protein levels before the onset of hepatitis. Evidently the factors responsible for sufficient growth of the breast to produce gynecomastia must be operative over a long period or must come into play only after unusually severe liver damage. EDWIN W. PASSARELLI M.D.

**Discussion: The Treatment of Cancer of the Breast** SIR GORDON GORDON TAYLOR, R. McWHIRTER, SIR STANFORD CADE, R. S. HANDLEY and F. M. ALICHA *Proc. R. Soc. Med., Lond.* 1948, 41 118.

GORDON TAYLOR states: I am a simple soul, a simple surgeon profoundly ignorant of the recondite



TABLE VIII.—SURVIVAL RATE OF ALL IN OPERABLE CASES IN THE PERIOD 1935-1940 MAIN METHOD OF TREATMENT—RADICAL SURGERY AND POSTOPERATIVE RADIOTHERAPY TOTAL CASES 221

Years after treatment	Number of cancer deaths	Number exposed to risk	Chance of dying in any one year	Survival rate, per cent
	138		6.24	7.8
	54	8	6.51	13
3	13	99	4.18	7
4		113	3.8	
5		6	16.7	

In the period from 1941 to 1945 there were 941 "operable" cases and the main method of treatment was simple mastectomy and postoperative radiotherapy. The 5 year survival rate was 55.9 per cent.

It will be noted that the 5 year survival rate for the period from 1935 to 1945 was higher than that for the two preceding periods. Statistical examination shows that the differences are significant. The findings therefore suggest that by not dissecting the axilla the risk of dissemination of cells to distant sites is reduced.

In the period from 1930 to 1934 few inoperable cases were recorded and no patients survived to the fifth year.

In the period from 1935 to 1940 the number of inoperable cases referred was 221 and at the end of 5 years only 2.5 per cent of the patients were alive. The results are little different from those obtained during the period from 1930 to 1934 and suggest that when radical removal was attempted the postoperative radiotherapy was rendered ineffective by dissemination of cells at the time of operation.

In the period from 1941 to 1945 the number of inoperable cases was 404 and the 5 year survival rate was 14.1 per cent.

Again the survival rates are higher than any obtained before and the differences are statistically

TABLE IX.—SURVIVAL RATE OF ALL INOPERABLE CASES IN THE PERIOD 1941-1945 MAIN METHOD OF TREATMENT—SIMPLE MASTECTOMY AND POSTOPERATIVE RADIOTHERAPY TOTAL CASES 404.

Years after treatment	Number of cancer deaths	Number exposed to risk	Chance of dying in any one year	Survival rate, per cent
	186	201	4.60	54
	81	8	4.56	59.4
3	5	69.8	2.60	18.8
		26	3.4	5

TABLE X.—SURVIVAL RATE OF ALL OPERABLE AND "INOPERABLE" CASES IN THE PERIOD 1935-1940. MAIN METHOD OF TREATMENT—RADICAL SURGERY AND POSTOPERATIVE RADIOTHERAPY TOTAL CASES 790.

Years after treatment	Number of cancer deaths	Number exposed to risk	Chance of dying in any one year	Survival rate, per cent
	3	786.8	29.4	70.6
	96	155.8	1.64	98.3
3	61	305	19.5	41
		12	5.8	33.7
		26.7	60.1	52

significant when comparison is made with either of the two preceding periods.

In the period from 1941 to 1945 the total number of cases operable and "inoperable" referred to the Royal Infirmary was 1,345 and the 5 year survival rate of 43.1 per cent is higher than that of the period from 1935 to 1940. Statistical examination shows that the difference is significant.

Carcinomatous breast without distant metastases. When the cases with clinical or roentgenographic evidence of distant metastases are excluded from the total patients seen in the period from 1941 to 1945 the 5 year survival rate is 50.1 per cent.

#### PRESENT TREATMENT METHODS

The technique of simple mastectomy and postoperative radiotherapy is being continued with the addition of ovarian irradiation, which has been added with a view to influencing distant metastases.

Technique of simple mastectomy and postoperative radiotherapy. This method is a combination of two procedures which must be co-ordinated if the best result is to be obtained.

The following points are of importance:  
1. Preoperative preparation by iodine is contra-indicated because it lowers the skin tolerance to radiotherapy.

TABLE XI.—SURVIVAL RATE OF ALL "OPERABLE AND "INOPERABLE" CASES REFERRED IN THE PERIOD 1941-1945 MAIN METHOD OF TREATMENT—SIMPLE MASTECTOMY AND POSTOPERATIVE RADIOTHERAPY TOTAL CASES, 1,345

Years after treatment	Number of cancer deaths	Number exposed to risk	Chance of dying in any one year	Survival rate, per cent
	66	1,345	9.4	80.6
	59	890.8	1.6	64.8
3	2	309.8	1.61	51
	23	59	3.6	47.5
		9.7	60.1	43

TABLE XII—SURVIVAL RATE OF ALL 'OPERABLE' AND ALL LOCALIZED "INOOPERABLE" CASES IN THE PERIOD 1941-1945 MAIN METHOD OF TREATMENT—SIMPLE MASTECTOMY AND POSTOPERATIVE RADIOTHERAPY TOTAL CASES, 1146

Years after treatment	Number of cancer deaths	Number exposed to risk	Chances of dying in any one year	Survival rate, per cent
	130	1,465		87.9
	119	754.5	.15	74.5
3	75	450.5	.52	61
4	23	249.5	.13	54.8
5	8	94	.085	50

2 The skin incision and the undermining of the skin flaps should be as limited as possible so that tissue spaces outside the area to be irradiated will not be contaminated with malignant cells liberated during the operation

3 Excessive skin should not be removed for tension on the skin flaps may be associated with failure of the wound to heal and delay in the application of radiotherapy. Tightly stretched skin flaps do not tolerate radiation well. Skin grafting does not overcome the difficulty for grafts do not tolerate roentgen ray treatment well

4 When the primary tumor is mobile on the pectoral fascia, the fascia should not be removed as this promotes fibrosis of the pectoral muscle. If the tumor is firmly fixed to the pectoralis major the muscle should be removed together with the breast.

5 If there are no palpable axillary glands no dissection should be performed, but superficial mobile glands in the subpectoral region and outside of the axilla may be removed. Any further dissection of the axilla will defeat the whole purpose of the treatment method advocated.

6 If the patient is very stout it is better to carry out a radical operation because in stout patients it is difficult to deliver an adequate dose of roentgen rays to the axilla.

7 Supraclavicular glands should never be removed because these glands are easily and effectively dealt with by radiotherapy

8 Adhesive should not be applied to the skin after the operation because this lowers the tolerance of the skin to radiation

The following points are of importance in the post operative treatment by radiotherapy

1 Only one full course of x ray treatment should be given. The practice of repeated courses at intervals of from 3 to 6 months has no place in the treatment of any form of malignant disease in which cure is to be attempted and is just as illogical as partial removal of a tumor at intervals of 3 to 6 months

2 X ray treatment should be commenced as soon as possible after the operation the usual interval is 2 weeks

3 The chest wall must be treated by tangential or glancing fields so as to avoid lung fibrosis

4 An adequate dosage must be given and in Edinburgh the patients receive a minimal tumor dose of 3750 roentgens in a period of 3 weeks

5 The x ray apparatus must be sufficiently powerful to deliver an adequate depth dose in the axilla and it is doubtful if effective radiotherapy can be given with an apparatus of lower voltage than 250 kv

CADE suggests the following classification of cancer of the breast: stage 1—tumor of the breast only; stage 2—tumor of the breast with skin changes or involvement of the axillary glands or with both; stage 3—tumors of the breast with involvement of the supraclavicular glands or contralateral axillary glands, or fixation to the pectoral fascia; and stage 4—skeletal or visceral metastasis.

The choice of the method of treatment should be guided by many factors. The best results following the best form of treatment are not unnaturally achieved in the best cases and so far radical mastectomy achieves them more frequently than all other therapeutic measures.

Radiation is of value

1 As the sole method of treatment in stage 3 cases the end results following radiation are better than those following surgery

2 As a preoperative measure in stage 2 cases in which improved results can confidently be expected.

3 As a postoperative measure chiefly in stage 2 cases

HANDLEY said that he had removed the second intercostal space gland of the internal mammary lymphatic chain in 20 cases of carcinoma of the breast, and his collaborator Thackray had examined the material microscopically. The study had so far been chiefly a pathological one with the object of finding out how often the internal mammary glands were invaded in carcinoma of the breast and the second intercostal space had been chosen because it contained the largest and most constant gland of the chain. In the 20 cases examined no glandular involvement had been found in 6 patients; both intercostal and axillary glands were invaded in 9 patients; in 3 patients only the axilla was involved and in 2 only the intercostal gland. It was easy to open the intercostal space but more difficult to find the gland, although matting of the tissues around the internal mammary artery usually betrayed invasion of the space. The largest invaded gland encountered had been the size of an orange pip; the smallest the size of a pinhead. Although clinical recurrence in the second intercostal space was not very common in these days it was difficult to believe that carcinoma cells living almost on the pleura were harmless. If the intercostal glands were invaded the patient could not be cured by surgery alone and additional radiotherapy was necessary. It was thought that if the axilla was clinically free from invasion or showed mobile glands, the operation should start with a second intercostal space biopsy. If a rapid

frozen section showed the space to be free from growth, a radical mastectomy should be done. If however the space was invaded the operation should be limited to a simple mastectomy with additional removal only of such of the axillary contents as are within easy reach. Radiotherapy must deal with the deposits within the chest and might as well cope with the apex of the axilla.

ALLKIN emphasized the value as a preoperative measure of irradiation of tumors of the breast in stage 3 cases. Those who have been fortunate enough to see the results of such treatment could not but fail to be impressed. The gross changes produced by interstitial radium treatment so ably carried out by Keynes and a few others had been repeated with x-rays. Many breasts thus irradiated had shown a complete absence of active cancer cells on histological examination after removal. These were what might be termed the more radiosensitive tumors. In the more resistant types, shrinkage of tumors is not so marked and many malignant cells are found throughout the breast after irradiation. The fact must be recognized that in both types there are still potentially malignant cells remaining which may start into a period of activity at some future date, hence the necessity for the operative procedure after irradiation before such activity begins. These remarks applied with even greater emphasis to the axillary glands which in Allkin's technique are irradiated at the same time as the breast. As it was more difficult to remove all traces of malignant cells from metastatic glands, the necessity for the clearance of the axilla became even more apparent.

JOHN J. MALONEY M.D.

#### Management of Advanced Cancer of the Breast.

ARTHUR W. ELLIOTT. *Radiology* 94:5, 50: 7

Advanced cancers of the breast may be divided into two groups (1) those in which the disease is local but has advanced to ulceration and fixation to the chest wall and (2) those with widely disseminated metastases. The former is best managed by surgery supplemented with roentgen therapy as indicated.

The patients with advanced metastases are best treated symptomatically. Castration, either surgical or with x-rays, is believed to be the most important single procedure to retard the course of advanced breast cancer. Pain due to nerve or bone involvement may be controlled with x-rays, surgical means, cobra venom, or narcotics. Questions asked by persons in full possession of their faculties should be truthfully answered, either by infirm patients may be spared needless worry by indirect replies.

FRANK B. QUINN M.D.

#### TRACHEA, LUNGS, AND PLEURA

*Pulmonary Cavernous Hemangiomas with Arteriovenous Fistula: Surgical Management.* J. DEWITT BIGGARD. *Ann. Surg.* 1947 25: 965.

Visceral hemangiomas are uncommon. Autopsy records indicate an incidence of less than 0.3 per cent.

Hemangiomas of the lung are rare and for this reason this case is added to the small group previously reported.

How these lesions should be classified is of academic interest principally. Anatomically they are hemangiomas, physiologically arteriovenous fistulas. Probably all pulmonary hemangiomas are congenital. Their presence has been demonstrated in newborn infants, and in some of the reported cases there has been a history of cyanosis since infancy. Way symptoms do not appear until later in life in some cases may be explained by the fact that cyanosis and symptoms associated with it result from a large shunt of blood from the pulmonary artery to the pulmonary veins. It has been estimated that at least 25 per cent of the blood must be shunted before cyanosis is apparent. It would seem reasonable to assume that a small fistula through a hemangioma would progressively enlarge to a size that would produce symptoms as time passed. There is no record of a pulmonary arteriovenous fistula of traumatic origin and, furthermore, in the reported cases there is no definite evidence of an etiologic factor other than a congenital one.

In terms of oxygen saturation the direction of blood flow through a fistula in the lung is the reverse of that through a shunt in the systemic circulation. Therefore much of the blood leaving the left ventricle is venous and unsaturated with oxygen so that some degree of cyanosis is a constant symptom. The cyanosis is somewhat distinctive in that there is no associated enlargement of the heart or other evidence of a cardiac lesion but there are, with exceptions, compensatory polycythemia, polyemia, and hyperhemoglobinemia with an increased hematocrit and reduced oxygen saturation. The degree of cyanosis and polycythemia is dependent upon the size of the fistula and the volume of the shunt, and the increase in the number of red cells accounts for the increased blood volume there being no appreciable increase in serum and none in the number of white blood cells and platelets. The blood picture differs also from that of true polycythemia by absence of changes, such as basophilic stippling and immaturity of the white cells. A constant finding is the presence of one or more chronic nonprogressive pulmonary lesions which roentgenographically are cylindrical masses and which under the fluoroscope, often may be observed to pulsate. In laminagraphs the cylindrical configuration and branching character of the lesions may be demonstrated.

In five of the reported cases and in the author's case a continuous murmur was heard over the pulmonary lesions and in each instance it was loudest at the end of deep inspiration.

Clubbing of the fingers and toes is a constant finding. The extent of these changes varies with the duration and the degree of cyanosis.

Other symptoms are variable, including pain in the chest, cough, dyspnea, asthmatic paroxysms, hemoptysis, fatigue, vertigo, faintness, headaches, syncope, and disturbances of speech and vision.

Treatment consists of ablation of the fistula. This can be accomplished only by surgical interference. Operation is indicated in the absence of incapacity and even in the absence of noteworthy symptoms because of the risk of fatal hemorrhage from rupture of the hemangioma and of sequelae resulting from thromboses secondary to the polycythemia.

Seven patients, including the author's, have been operated upon and all have been cured. In 4 cases (Shenstone and Jones, Jones *et al.*, Adams *et al.* and Goldman) a total pneumonectomy was done in 2 including the author's case, a lobectomy, and in 1 case (1 of Jones) local excision of multiple bilateral lesions was done. The ideal operation would eradicate the hemangioma by interrupting the vessels communicating with it without sacrificing pulmonary tissue. Unfortunately this was technically impossible except in Jones' case.

Cavernous hemangioma of the lung is a relatively rare lesion but not as rare as the number of reported cases suggests. It is probably a congenital lesion and may exist without symptoms until an arteriovenous shunt becomes established or enlarges to such a size as to cause considerable reduction in the oxygen saturation of the arterial blood. There is then a characteristic syndrome—a demonstrable pulmonary lesion which may be demonstrated to have characteristics of a vascular tumor by roentgenographic studies and an associated generalized cyanosis with clubbing of the fingers and toes. In most cases, there is a compensatory polycythemia.

Treatment consists of ablation of the fascicular fistula. Ideally this should be accomplished without sacrificing pulmonary tissue, as was done in 1 case. Usually this is technically impossible and eradication can be accomplished only by means of a lobectomy or pneumonectomy. Since there is much hazard of a fatal hemorrhage or of thrombotic sequelae from an associated polycythemia, surgical interference is indicated in the absence of incapacity and even in the absence of troublesome symptoms if there are no additional factors to increase the risk seriously. JOHN E. KIRKPATRICK, M.D.

**The Glandular Bronchial Epithelium as, Bronchial Adenomas (Les épithéliomas glandulaires bronchiques: a stroma remane et a évolution prolongée)**  
M. BARIQY and J. PAILLON. *J fr méd chir thorac* 1947 1 356

Bronchial adenomas are characterized by slow growth, rare metastases, and by their polypoid nature as seen through the bronchoscope. They are usually composed of an intrabronchial as well as an extrabronchial portion joined together by a narrow pedicle extending through the annular cartilaginous rings. A fibrous capsule tends to form around that portion extending into the pulmonary parenchyma. The intrabronchial portion most often causes complete obstruction of the bronchus from which it arises so that atelectasis, bronchiectasis, or suppuration of the lung distal to the lesion are commonly encountered.

The exact place of the adenomas with respect to benignity or malignancy is debatable. The slow growth and absence of atypical cells are in favor of their benign nature. The slow but progressive extension and the occasional distant deposits suggest that some of them at least are malignant.

Surgical extirpation either by lobectomy or pneumonectomy is strongly advised for with complete removal the best results of treatment of all pulmonary neoplasms can be expected. Removal through the bronchoscope is to be condemned except in rare instances. Such a procedure which removes only the endobronchial portion of the tumor provides only momentary relief because the large extrabronchial portion assures persistence of the tumor. The purely endobronchial type of lesion is observed but rarely. ORVILLE F. GRIMES, M.D.

**Carcinoma of the Lung** ADRIAN LAURENT. *Am J M* 56 1948 215 1

The importance of early diagnosis in lung cancer is emphasized by the fact that in 80 per cent of the 349 cases studied on the Chest Division of Bellevue Hospital, New York, over a 7 year period (1939-1946) the diagnosis was not made when the cancer was sufficiently localized to permit exploration. Only 70 patients, or 20 per cent, were explored.

Among the 70 patients explorable, resection was possible in only 25, or 7.1 per cent of the total group.

The duration of symptoms before hospitalization for the resectable group averaged 7 months and 7 days; for the nonresectable group, 9 months and 10 days.

The average hospital time until exploration was 40 days and the total hospital time averaged 87 days. Pneumonectomy was done in 20 of the 25 cases and lobectomy in 5.

Sixty-three of the patients were examined by means of the bronchoscope. Thirty-six (57.1%) had a positive biopsy; in 11 (17.5%) the biopsy was inconclusive and in 16 (25.4%) the bronchoscopy findings were negative. The daily sputum volume could not be correlated with the resectability.

Seventeen of the 70 patients operated upon died in the hospital; a mortality of 24.3 per cent. Five-year survival has been attained by only 1 patient; thus far. FRANK B. QUINN, M.D.

## ESOPHAGUS AND MEDIASTINUM

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Puestow and Chess believe that resection of the esophagus for stricture with esophagogastric anastomosis high in the chest is becoming practicable largely as the result of progress in anesthesiology and in the use of antibiotics and also as the result of experience gained in the use of this procedure in the treatment of carcinoma of the esophagus. However, radical resection is still a dangerous procedure and may carry with it a higher mortality than more

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ORVILLE F. GRIMES, M.D.

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FRANK B. QUEEN, M.D.

## ESOPHAGUS AND MEDIASTINUM

**Resection of the Esophagus for Persistent Stricture.**

CHARLES B. PUESTOW and STEPHEN J. CHESSE  
*Arch. Surg.* 1948 56: 34

Puestow and Chess believe that resection of the esophagus for stricture with esophagogastric anastomosis high in the chest is becoming practicable, largely as the result of progress in anesthesiology and in the use of antibiotics and also as the result of experience gained in the use of this procedure in the treatment of carcinoma of the esophagus. However, radical resection is still a dangerous procedure and may carry with it a higher mortality than more

conservative methods of therapy. Nevertheless the end-result makes it justifiable as it restores the patient a normal eating habits and frequently overcomes pre-existing abnormal psychic states.

Four case histories of patients in whom persistent stricture was treated by resection and anastomosis are reported in detail. Three survived the operation and are doing well the fourth patient died on the sixth postoperative day with atelectasis of the left lung and hydrohemothorax, edema of the right lung, and bronchopneumonia. There was, however no evidence of leakage from the gastrointestinal tract.

A modified Sweet technique of esophagectomy and gastroesophageal anastomosis was used in each instance. Removal of the seventh rib division of the sixth and fifth ribs, and insertion of the Rawson Abbott tube through the anastomosis are the main departures from Sweet's procedure.

Certain anatomic relationships which may protect against pitfalls the use of the procedure are discussed as well as the preoperative and postoperative care of the patient, complications and the treatment.

STEPHEN A. ZIDMAN M.D.

**Surgical Treatment of Perforation of the Esophagus.** JOHN M. DORSEY *Arch Surg* 94:3, 56-74.

To the list of spontaneous perforations of the esophagus must now be added that which may follow instrumentation. This inevitably will occur as peroral endoscopy for diagnosis becomes more widely used. When positive evidence has accumulated such as substernal epigastric or shoulder pain, elevation of temperature and leucocyte count followed by persistent pain worsened by deep inspiration in a patient who demonstrated normal findings before instrumentation, then active treatment should be instituted. It should be adequate to the pathologic changes that occur subsequent to esophageal perforation. Four case histories are given to show what was considered adequate therapy.

In the first case treatment with hot compresses and penicillin therapy was sufficient.

In the second case cervical mediastinotomy and drainage with penicillin resulted in recovery.

The third case was that of a patient who had swallowed a piece of beef which lodged above the esophageal hiatus of the diaphragm. It was removed partly through a gastrotomy and partly by means of esophagocopy.

Dorsey discusses the use of papain as a digestant in these cases, particularly where there is no evidence of perforation. The papain will digest the bolus and substitute for the need of surgical intervention.

The fourth case was that of a patient who had swallowed a piece of lamb chop and sustained a perforation following esophagocopy. Diagnosis was made because of the widening of the mediastinal shadow on roentgenogram, and the rise in temperature. A gastrotomy and mediastinotomy resulted in complete cure of the patient.

STEPHEN A. ZIDMAN M.D.

**Carcinoma of the Esophagus. An Analysis of 145 Cases, with Special Reference to Metastases and Extensions.** GEORGE J. TAQUINO and GERALD F. JOSEPH. *Ann Otol Rhinol* 54:7 56-64.

In 1935 in a report on 506 patients with carcinoma of the esophagus observed at Memorial Hospital in New York over the 13 year period ending in 1931, Watson made the statement that a cured case of this disease is a medical curiosity and that it seems wise in view of its rapidly fatal character to attempt cure only in the very few favorable cases and to treat the remainder routinely by palliative methods. In 1942, in a review of 930 cases of carcinoma of the esophagus this same observer stated that after 15 years' experience with the disease he had become considerably more optimistic about it. The reason for his optimism was twofold: the method of external radiation carried out for the previous 2 years at Memorial Hospital and the recent advances in trans thoracic esophagogastronomy and esophagogastricomy. In 1945 Sweet put on record 73 radical resections followed by some form of anastomosis for carcinoma of the esophagus. The most significant feature of his report was that, while only one of these operations had been performed in 1939, 34 had been performed in the first 10 months of 1944. Since that time Sweet has materially increased the number of his own cases, and numerous other surgeons have put on record many other cases in which curative operations were performed.

These observations indicate that the professional pessimism with which carcinoma of the esophagus was once viewed has over the past decade become a modified and cautious optimism. Cured patients perhaps are no longer rare but they remain exceedingly uncommon. Radical resections, however are no longer surgical curiosities. In fact they have become standard procedure in every case that is not frankly hopeless for two very good reasons, namely the remarkable recent advances in intrathoracic surgery and the completely justifiable position that if a disease is hopeless without treatment almost any risk that offers a chance of salvage is worth the taking.

The general situation of course is not nearly as bright as these facts might suggest. The outlook on carcinoma of the esophagus has changed, it is true. Technical advances in both surgery and radiation therapy have made cures of the disease at least theoretically possible. Surgical courage allied with sound judgment, has extended the indications for resection while at the same time the mortality, although still not small, is no longer prohibitive. However to the great majority of patients with carcinoma of the esophagus these brilliant advances mean nothing. The disease in most cases is still detected too late to permit any but palliative treatment if indeed to permit any treatment at all.

A study of 45 cases of carcinoma of the esophagus 124 proved by postmortem examination and the remainder indubitable instances of the disease shows the usual gloomy picture of advanced processes,

widespread metastases and extensions nonresectability and the almost 100 per cent mortality characteristic of most reported series. Two patients who had radical operations were alive when last seen at the end of a year but have been lost from sight. Six patients who had radiation therapy by a new technique have been kept alive from 9 to 18 months. All the other patients in the series are either dead or have no hope of survival because they were not submitted to any procedure which gave them any chance of life.

The duration of symptoms in this series ranged from less than a month to 18 months (in a single, possibly questionable case). The average duration was less than 5.5 months. Yet metastases were identified by clinical methods in 16 different sites in 38 patients who survived the period of observation and they were identified at autopsy in 19 different sites in 30 of 44 patients subjected to autopsy. In addition, extension of the malignant process was identified in 12 different sites in 20 patients, 17 of whom presented complications in the sites to which exten-

sion had occurred. A total of 88 patients, 60.7 per cent of the whole series, was thus eliminated from all hope of cure by surgery because in this disease radical surgery is contraindicated for all practical purposes when metastases and extensions have occurred. It seems doubtful that radiation therapy, even by new methods, can achieve anything at all in such cases.

The solution of the problem of carcinoma of the esophagus in the general run of cases still seems very far off. Advances in surgery and in radiation therapy are applicable only to the small and highly favored group of patients whose disease is recognized early enough for these measures to be useful. Hope for the rest lies in the recognition by physicians in general that even the most trivial symptoms which might point to the disease must be fully and repeatedly investigated. Since esophagoscopy and biopsy are the definite diagnostic methods, the responsibility of the esophagoscopist for the end results in this disease is correspondingly heavy.

JOHN E. KIRKPATRICK, M.D.



# SURGERY OF THE ABDOMEN

## ABDOMINAL WALL AND PERITONEUM

**Hernia of the Intersigmoid Foramen; A Contribution to the Study of Internal Hernias (Hérnia da fosseta intersigmoide; contribuição ao estudo das hérnias internas)** MAURICIO ROCHA and JOSÉ DODWORTH MARTINS. *Rev. med.* 1947 15 30.

Hernia of the intersigmoid foramen is the most uncommon of the internal hernias, its incidence amounting to 5 per cent. Clinically its symptoms may be limited to some vague pains in the hypogastrium and the periumbilical region but its history reveals repeated attacks of indigestion with epigastric pain and more or less rebellious constipation, which suggests varying degrees of intestinal obstruction. Incarceration of the intestinal loop sometimes occurs suddenly and severely aggravates the condition. This loop always belongs to the ileoterminal group and the clinical picture does not differ essentially from that of the classical mechanical ileus occurring in the small intestine.

Retention of feces and gas is usually early and vomiting also occurs early as a reaction to the initial pain. After the initial period, vomiting may be delayed because of the relatively low seat of the ileus. The pain, of colicky type in the beginning, gradually increases in severity; it occurs early with remissions but soon dominates the picture and becomes lancinating; it is located at the level of the inferior mesenteric plexus.

Inspection may show intense peristaltic movements and asymmetry of the abdomen with rounded tumefaction, periumbilical swelling on the right side and hypogastric concavity. This is due to the presence of a more or less voluminous hernial mass in the mesogastrium. The mass is soft, globular somewhat mobile, of variable size and uninfluenced by respiration. Percussion reveals a resonant tympanic sound auscultation discloses gurgling and intestinal sounds. Inspection shows intestinal loops with their peristaltic movements raising the center of the mass when the abdominal wall is thin. As the period of strangulation increases, the distention becomes greater and masks this sign. Circulatory changes resulting in extravasation of blood into the peritoneal cavity cause the appearance of a picture of peritoneal irritation.

The anatomopathologic changes in the sigmoid range from simple subocclusion by compression to torsion or volvulus. They develop slowly and insidiously, and the paradoxical association of ileus of the small intestine with signs of low obstruction is highly suggestive of hernia of the intersigmoid foramen. Roentgen examination often suggests the diagnosis. In complicated hernias, especially in the beginning, roentgenography reveals two suggestive elements: elective distention of some loops, well localized, with regular limits and sacular aspect, and apparent ab-

sence of loops from the left side of the abdomen and the pelvis. With these elements supported by the clinical data it is quite possible to establish a correct preoperative diagnosis.

Treatment is always surgical. Reduction and freeing of the sac are not always easy. The presence of large vessels (sigmoid artery) contraindicates liberating incision. The loops must be freed by cautious traction under careful inspection. Partial incision of the sac and obliteration of the cavity by suture after reduction of the hernial contents, is especially useful in cases of volvulus or incarceration. The anatomic character of the region makes difficult this surgical maneuver which is recommended only in case manual liberation is absolutely impossible. The treatment of the herniated loop is the routine one.

The literature shows a steady decrease in the number of patients who died because they were not operated upon and a gradual decrease in the operative mortality because of early intervention. The authors describe a fatal case in which extensive resection of the small intestine was necessary but impossible.

RICHARD KEMEL, M.D.

**Indirect Inguinal Hernia; A Contrast between the Sites of Recurrence after the Simple and after the Plastic Operation.** C. CRAIG, Auckland. *N. Zealand J. Surg.* 1948 17 207.

Two series of cases of indirect inguinal hernia in patients operated on by the method of Russell are reported. The second of the series consisted of 54 cases which were carefully followed up. The recurrence rate in the second series was 3.3 per cent.

An analysis of the 30 recurring hernias in both series showed that 19 were indirect in type. In those reoperated on it was found that the new sac reproduced the original one exactly as far as site was concerned. The one direct recurrence was of the Ogilvie tubular type. After plastic operations involving gross interference with the muscles surrounding the inguinal canal there are not only indirect recurrences but also direct recurrences. These direct recurrences are very likely due to the operative interference with the posterior wall of the canal.

It is suggested that the plastic operation should be abandoned, except for certain types of advanced hernia, and that a new operation be devised. This should have as its main principle the establishment of a strong sheet of fascia between the exposed transversalis fascia and the origin of the cord. The author believes that part of the procedure would be re-education of the muscles.

Two additional methods are described: they are to be used either alone or as adjuncts to other methods: (1) the injection of sclerosing solutions during operation and (2) inversion of the sac. The treatment of 10 large sliding hernias is described as well as that of ordinary cases.

SAMUEL KAHN, M.D.

## GASTROINTESTINAL TRACT

The Effect of Tetraethylammonium on the Small Bowel of Man. WILLIAM P. CHAPMAN, JOHN B. STAMBUK and CHESTER M. JONES. *J. Clin. Invest.* 1948, 27, 34

The present report concerns the effect of tetraethylammonium ion on the intestinal tract of 8 patients as observed by the multiple balloon technique. Three patients were hypertensive of these one patient had a duodenal ulcer and another had had a lumbodorsal sympathectomy 4 years previously without any striking change in blood pressure. Three patients had intractable abdominal pain, presumably intestinal in origin. One patient had gastritis and one had rheumatoid arthritis.

It was found that tetraethylammonium causes an immediate cessation, or marked decrease of motility of the upper small bowel. This effect is more prolonged than the fall in blood pressure or rise in pulse which the drug induces. It is possible that buffer reflexes for the circulation are more highly developed and act for the more rapid return of blood pressure to normal. Within the limitations of the method used, the effect of the drug on the intestine is identical to that of atropine.

It is suggested that the mechanism of action of tetraethylammonium on the small intestine is not solely that of an autonomic blocking agent. Perhaps the drug has an additional action on the intrinsic neuronal structure or on the smooth muscle itself which is responsible for the continued activity following surgical denervation.

The fact that the thresholds for intestinal pain elicited by barium distention were unchanged following the administration of tetraethylammonium suggests that this drug has no significant action on the sensory innervation of the intestine. Its pain relieving effect must therefore depend on antispasmodic action.

The authors suggest that if continued use demonstrates its reasonable safety, tetraethylammonium may have diagnostic value in implicating smooth muscle spasm as responsible for the features of certain cases of obscure abdominal pain. Its value as a releasing agent in such conditions as ulcerative colitis and intractable peptic ulcer is limited at least at present, by its brief duration of action.

HAROLD LAUFMAN, M.D.

Rationale of Therapy in Pruritus Ani. RACHELLE SEITZ. *Am. J. Surg.*, 1948 75, 373

Pruritus ani is a complex syndrome characterized by recurrent attacks of itching, anospasm, insomnia, nervous depression and sluggish peripheral circulation, excessive perspiration in intertriginous areas, moderate leucopenia, a subclinical nutritional deficiency state, and a variety of skin lesions. The rationale of therapy must include the consideration of all these factors.

The nervous manifestations so characteristic of this disease are sluggishness, apathy and despon-

dency. These represent a vagosympathetic imbalance of the vagotonic type.

Any therapeutic measure that tends to calm the psychic state or reduce nervous irritability or tissue sensitivity is valuable whether it is bromides, barbiturates, calcium or one of the newer antihistamine drugs. The treatment of vitamin B deficiency is also important.

The basic pathologic condition consists of the triad of skin irritation, anospasm and lymph stasis.

Lymph stasis, which is caused by the slowing of peripheral circulation, allows the further accumulation of the irritating substance. Injection methods produce a phagocytic response and the phagocytic activity of the histiocytes produced by the reaction to these injections is known to remove toxins and protein particles, thus decongesting the peripheral lymph circulation.

Any rectal pathology which produces or intensifies rectal spasm should be corrected. The author uses the multiple puncture method of alcohol injection for itching. In the presence of scar tissue, redundant folds, pectinosis and marginal varicosities, surgical excision is performed and alcohol stippling is used to prevent recurrence of pruritus immediately following surgery.

Fungus invasion is aided by excessive perspiration and is signified by a linear abrasion or scaling in the intergluteal fold. The author uses boric acid ointment when irritation is extreme, and penetrating dyes to combat the fungus infection.

ERNEST D. BLOOMENTHAL, M.D.

Tattooing with Mercury Sulfide for Intractable Anal Pruritus. ROBERT TURELL. *Surgery* 1948, 23, 63.

The author presents an analysis of 93 (of a total of 106) cases of intractable pruritus in patients who had been treated by tattooing with mercury sulfide during the period from October, 1938 to November, 1942 and who had been followed personally and adequately for from 6 months to 4 years. At some time prior to tattooing, all of these patients had received various forms of treatment without lasting benefit. The antecedent therapeutic procedures included topical medicines, endocrine drugs, irradiation, psychotherapy, subcutaneous injection of oil-soluble, long acting 'anesthetic solutions' or alcohol, anorectal operative procedures or combinations of these forms of therapy. The pertinent data concerning this group of patients are depicted in the accompanying tables.

Fifty five of a group of 70 patients who had had chronic and recalcitrant anal pruritus associated with definite characteristic cutaneous changes have responded well to tattooing with mercury sulfide; the remaining 15 patients obtained 'satisfactory' results. Confirmation of this has been obtained in the treatment of vulval pruritus with cutaneous changes. Of 23 patients with similar complaints but who had no cutaneous changes consistent with chronic anal pruritus, only 6 obtained satisfactory

results while 17 showed no improvement. This too finds confirmation in the unsuccessful treatment by tattooing with mercury sulfide of vulval pruritus without cutaneous changes.

It appears that tattooing with mercury sulfide is an effective form of treatment for intractable anal pruritus which is associated with definite characteristic cutaneous changes in the absence of anorecto-colonic lesions. The patient who complains of severe anal pruritus but who has no cutaneous changes consistent with localized pruritus is in the majority of cases, an unfavorable candidate for this form of therapy. However since no deleterious effects have to date, been observed following tattooing with mercury sulfide this form of therapy may be given a trial in all cases of localized pruritus when more radical procedures such as the subcutaneous injection of ethyl alcohol or the radical excision of perianal or vulval skin are contemplated.

JOHN E. KIRKPATRICK, M.D.

**Primary Postoperative Hemorrhoidal Prophylactic Dressing in Anorectal Surgery** MARION C. PRUTTY *Am J Surg* 94, 75 392.

The author has found a very practical use for oxycel. In the present article he discusses the application of oxidized cellulose gauze (oxycel) as an anorectal dressing. It is applied quickly to the oozing wound after sulfonamide powder has been meticulously rubbed in. A piece of 3 by 3 inch oxidized cellulose gauze is folded to make a right triangle. A forceps grasps the gauze and inserts it into the anus halfway. The outside half is spread over the external orifice. Two more pieces of oxycel 4 by 4 inches, are placed over this and a pressure dressing consisting of a perineal pad is applied over the gauze pack and fixed with tape across the buttocks. The dressing is used in operations such as hemorrhoidectomy, fistula, polyp, new growth or other operations within or without the anus. The dressing can be removed safely usually after a period of 24 hours without pain or bleeding.

STEPHEN A. ZIEMAN, M.D.

**Treatment of Complete Prolapse of the Rectum.** HERBERT T. HAYES and HARRY B. HURR. *Am J Surg* 94, 75 358.

The authors report 9 cases of rectal prolapse and its treatment. In 3 patients, nothing more than simple reduction of the prolapse was necessary; sclerosing agents were used on 3 others with good results; the last 3 were subjected to abdominal operation. In one case in which it was impossible to free the rectum or to expose the pelvic fascia, the peritoneum was brought under the rectum or to expose the pelvic fascia, the peritoneum was brought under the rectum as a new pelvic floor.

In operating on the last 3 patients the authors used the technique of Graham together with construction of a new bed for the sigmoid, which they have added. After administration of a spinal anesthetic, an ordinary rectal tube was inserted into the rectum for about

2 inches before the abdomen was opened. Beginning at about the level of the superior hemorrhoidal vessels the peritoneum on each side of the rectum was incised down to the level of the cul-de-sac and then completely across the cul-de-sac. Finger dissection then freed the rectum from the hollow of the sacrum down to the coccyx just as though removal of the rectum were contemplated. Blunt dissection then freed the rectum anteriorly. The defect between the levators could easily be felt. At this point Graham closed the defect by approximating the levators with sutures drawn through the pelvic fascia over the levators.

Both of the authors' patients were males in whom this procedure was found to be technically impossible. Instead of suturing the levators together they brought the lateral ligaments of the rectum across in front of the rectum and sutured these ligaments together with one or two linen sutures. This took up the slack in the overstretched lateral ligaments and prevented the anterior wall of the rectum from prolapsing through the defect between the levators and then with the rectum held up taut, the cut edges of pelvic peritoneum were turned under and sutured to the rectum at the sides and anteriorly. This obliterated the cul-de-sac of Douglas or the rectovesical pouch entirely. As a further support to the repair they made a new bed for the sigmoid by incising the lateral peritoneal leaf from the brim of the pelvis up the lateral gutter for a distance of 4 to 5 inches. After blunt dissection of the thin areolar tissue under the sigmoid the peritoneal leaf was sutured to the wall of the sigmoid while the latter was held up taut.

In none of these patients has it been necessary to tighten or do any plastic work on the sphincter muscles since in each case the muscles were competent.

JOHN J. MALONEY, M.D.

**Modern Surgical Treatment of Hemorrhoids and a New Rectoplasty** A. GREGOR CARRILL. *Am J Surg* 94, 75 320.

The author states that the objective of hemorrhoidectomy is to remove all pathologic lesions and to restore normal anatomic configuration and normal function and to do so with a minimum of pain and morbidity.

The anal canal is an elastic tube surrounded in its entire length by voluntary muscle with a sphincteric action and contained within its upper two-thirds by the involuntary sphincter. It is lined by modified skin up to the scutellar valves and above them by mucous membrane. Connective tissue and epithelium regenerate but injured muscle is replaced by inelastic fibrous tissue.

The removal of too much circumference, damage to muscle and fibrous replacement may cause stenosis. Seepage may be due to a downward displacement of the secreting mucosa. The early recurrence of hemorrhoids is usually caused by inadequate removal.

A complete histologic and digital and sigmoidoscopic examinations should precede surgery to rule

out the presence of neoplasms. Roentgen examination may be necessary to ascertain the condition of the upper reaches of the colon.

Preoperative preparation includes the administration of sulfathalidine 1 gm. four to five times daily for 4 days before surgery and for 7 to 10 days after ward and a bland diet 24 hours preoperatively. Sedation is obtained by the administration of sodium pentobarbital  $\frac{1}{2}$  gr. the evening before surgery and if local or regional anesthesia is employed 1 hour before surgery. Morphine sulphate  $\frac{1}{6}$  gr. and scopolamine  $\frac{1}{150}$  or  $\frac{1}{200}$  gr. is given hypodermically one half hour before operation.

The author favors spinal anesthesia which is produced by the injection of 20 mgm. of procaine which also contains 1 to 20,000 suprarenin. This has given satisfactory anesthesia for one hour or more. The oil soluble reagents and diathane solution are also used to produce prolonged anesthesia and thus lessen postoperative pain. The Bue prone position with the buttocks elevated, either the left or right lateral position is preferred during the operation. Good surgery is most important to reduce postoperative pain.

The object of the surgical treatment of hemorrhoids is to produce a canal which will readily admit at least two fingers with the patient under anesthesia and one which is readily elastic and has a mucocutaneous junction which is no lower than the normal pectinate line that is 2 to 3 cm. from the anal margin.

Radial excision is most frequently employed for simpler cases and has the advantage of leaving adequate islands of uninjured tissue. Extensive hemorrhoidal involvement requires circumferential excision, with the danger of ensuing stenosis. The author uses sliding skin grafts and occasionally anastomosis to prevent contractures. Relaxing incisions are used to allow the adjustment of skin to mucosa.

FRANK D. BLOOMSBOM, M.D.

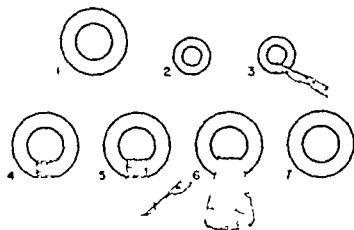


Fig. 1 (Carmel). Diagram illustrating preparation of sliding graft and anastomosis in plastic repair of anal stenosis also employed to prevent contractures following radical hemorrhoidectomy. 1. Normal anal lumen. 2. A stenosed anal. 3. The anastomosis. 4. Separation of wound edges and consequent widening of anal tube. 5. Incisions for preparing sliding skin graft. 6. Graft has been drawn up to cover entire surface of anal wound except for a narrow radiating slit. 7. End result.

#### Surgical Treatment of Chronic Ulcerative Colitis

GARNETT W. ALLEN, M.D., J. Surg. 1945, 75:325

One hundred and ten cases of chronic ulcerative colitis seen during the period from 1935 to 1946 are reviewed. Patients in whom the condition was classified as mild progressed favorably, but in 15 to 20 per cent of the patients the colitis had reached an advanced stage. The author deals with the treatment of this latter group.

Patients were classified as having chronic ulcerative colitis when they presented clinical, roentgen and proctoscopic features of this disease as described by Rankin, Hargen and Bue. The advanced stage was reached by an initial fulminating attack (most



Fig. 2 (Carmel). Radical type (circumferential hemorrhoidectomy) with utilization of sliding graft. 1. Three initial sutures. 2. Three additional sutures. 3. Depicts final result showing graft and sutures employed for bowel

control. 4. Graft has been drawn up to cover entire surface of anal wound except for a narrow radiating slit. 5. Graft has been drawn up to cover entire surface of anal wound except for a narrow radiating slit. 6. Graft has been drawn up to cover entire surface of anal wound except for a narrow radiating slit. 7. End result.

TABLE I.—STATUS OF OPERATIVE PROCEDURE IN TWENTY PATIENTS

ST	Operative procedure	No. Deaths	
		No.	Per cent
A	Postoperative mortality		
	6 Deceases without colectomy		66
II	3 Ileostomies—total colectomy—rectum left in		
III	3 Ileostomies—total colectomy—abdominoperineal		
IV	Ileostomy—rt colectomy		100
V	Left colectomy—abdominoperineal		
VI	Total colectomy—ileosigmoidostomy		100
VII	Segmental resection—ileostomies		
		3	85
B	Chronic ulcerative colitis mortality		
	Ileostomy—Deorotic fistula (from above)		100
	Colectomy—carcinoma—ileoperable		100
			87

of these patients die) or by chronic and recurrent attacks (most of the patients in this stage can be rehabilitated surgically)

Specific indications for surgery are visceral degenerative changes anorectal complications polypoid

TABLE II.—STATUS IN RELATION TO OBJECTIVE IN TWENTY PATIENTS

	Per Cent
3 Restored to health	60
3 Convalescent	60
3 Postoperative mortality	5
3 Chronic ulcerative colitis	5
1 Unknown	5
20	100

degeneration and carcinoma, obstruction and tumor mass, and subacute perforation. Elective indications for surgery are focal infection, hemorrhage, acute fulminating ulcerative colitis and acute perforation.

The goal of surgical rehabilitation of the patient is a return to previous occupation and good health without limitation of activities. Operative proce-

TABLE III.—MORTALITY STATUS IN FIVE PATIENTS

A	Postoperative mortality	5 per cent
I	Ileostomy—perf Deum—peribulbide	
I	Ileostomy—rt colectomy—perf colon—peribulbide	
I	Explore—adhesions—peritonitis	
B	Chronic Ulcerative Colitis Mortality	10 per cent
I	Ileostomy—ileocolic fistula	
I	Colectomy—carcinoma—ileoperable	

dures used were ileostomy. Ileostomy with total colectomy except the rectum. Ileostomy with total colectomy and abdominoperineal resection. Ileostomy with right colectomy left colectomy and abdominoperineal resection. Ileosigmoidostomy and total colectomy segmental resection with anastomosis and colectomy for inoperable carcinoma.

A restoration to health and previous occupation was accomplished in 70 per cent of the patients.

ERNEST D. BLOOMENTHAL, M.D.

Primary Resection of the Colon and Rectum with Particular Reference to Cancer and Ulcerative Colitis. OWEN H. WASHINGTON and ROBERT W. TOOK. *Am. J. Surg.* 948, 75: 384.

The improved record with reference to operative mortality has allowed surgeons to focus their attention upon the problem of the ultimate cure of cancer of the lower intestinal tract. The authors recount their experiences with primary abdominal resection of carcinomas of the rectum and rectosigmoid and their lymph node drainage areas, accompanied by re-establishment of intestinal continuity.

In cancer of the colon the authors practice wide excision when lymph nodes are enlarged in the mesentery. When the left colon is involved it is almost completely removed from the splenic flexure to the sigmoid, and the transverse colon is anastomosed to the terminal pelvic colon. When indicated the greater portion of the entire colon is excised and an ileosigmoidostomy is performed to re-establish continuity. It is believed that more radical excision will produce more cures and less recurrence. Sometimes the transverse colon is mobilized for anastomosis to the rectum.

The authors present their results with anastomotic operation for rectal (within 13 cm. from the anus) and rectosigmoidal (between 13 and 30 cm. from the a u) lesions. Some cases of ulcerative colitis are included.

The operative technique employed was that of end-to-end suture with a single row of interrupted silk sutures (No. 0000). A Lambert type stitch, spaced approximately 3 mm. apart, was used. Anastomosis was performed as low as 3.5 cm. from the anal orifice. The abdominal pull through operation with complementary colectomy (to be closed later) was performed rarely.

The anastomotic method which preserves the sphincter is a more conservative operation. It is too early to assess the results definitely. However restoration of intestinal continuity may be performed as a one-stage operative procedure after excision of the terminal pelvic colon and upper rectum, with a hospital mortality comparable to that attending performance of the abdominoperineal operation. Functional sphincteric control is complete after the suture operation. The sphincteric control is not quite as good following the abdominoperineal pull through operation and the healing phase in this operation is much longer. The preservation of the internal sphincter insures continence.

In lesions of the rectosigmoid local recurrence has not followed primary resection with anastomosis. However, the incidence of local recurrence following conservative procedure for lesions at 8 cm. or less from the anus is frequent enough to suggest that sphincter-saving operations are contraindicated in all low-lying lesions. In the middle rectal segment or rectal ampulla above 8 cm., the conservative operation is a satisfactory operation for suitable cases and holds out to such patients approximately the same promise of cure as does the more radical abdominoperineal operation. For dubious lesions in this area the abdominoperineal operation is the procedure of choice.

Local recurrence occurred more often in lesions at 8 cm. or less from the anus and the remainder of recurrences were in lesions at between 9 and 13 cm. from the anus. In the entire group, local recurrence was observed in 7 of 51 cases (14%). Local recurrence was almost invariably outside the anastomotic area and the percentages compare favorably with the radical abdominoperineal resection.

Unsuspected polyps were frequently found in a more proximal segment of the colon. As polyps are precursors of cancer of the colon, it is suggested that wider and more radical excisions may be productive of more cures.

The anastomotic procedure was employed with some success for extrinsic rectal tumors and for ulcerative colitis. Satisfactory rectal continence and preservation of normal sex function is quite uniform after performance of resection with end to end anastomosis.

LESLIE D. BLOOMFELD, M.D.

**Production of Allergic Gastric and Duodenal Edema which Predisposes to the Histamine-Provoked Ulcer in Dogs.** STANLEY R. FRIESEN, DAVID STATT, DONALD L. JAFFER, MINNIE FISK, and OWEN H. WANGENSTEEN. *Surgery* 1948 23: 167.

The authors report a method of experimentally producing prolonged gastric and duodenal edema in dogs on an allergic basis. The animal was sensitized passively and locally (stomach and duodenum) by the local injection of antibodies, followed later by the systemic administration of antigens.

It was determined that local gastrointestinal edema with alteration of the general condition of the dog favors the development of the histamine provoked ulcer and that local anaphylaxis produced by passive local sensitization of the gastric or duodenal mucous membrane with local antigen antibody reaction abet the ulcer diathesis.

ROBERT T. FILL, M.D.

**Jejunitis Acuta—Helit's Regionalis Acuta.** H. C. BAYBICK. *Sch. Med.* 1948 6: 351.

The author describes 21 cases of acute jejunitis in 16 cases of acute regional ileitis. These conditions are believed to be the same or complaint with a different localization. In the opinion of the author, acute jejunitis occurs more frequently than is generally supposed. In most cases one may arrive at a correct diagnosis with the aid of roentgenographic examina-

tion. Jejunitis may be divided into two forms—acute phlegmonous jejunitis which carries a heavy mortality, and a light mild form which the author suggests should be called acute jejunitis. This last form is little known and may frequently be undiagnosed. Jejunitis may be followed by stricture which has often been described in the terminal part of the ileum.

The cause of the complaint is believed to be infection from the intestine with further spreading to the submucosa or possibly through the lymphatic channels. Exogenous microbes are believed to be of importance as a source of the infection.

The author emphasizes the importance of bacteriological examination and also of follow up examination of the patient.

JOHN J. MALONEY, M.D.

**Pathophysiology of Peptic Ulcer. A Clinical Study of 115 Cases Treated with Ergotamine.** ALLEN L. *Sch. Med.* 1947 120 Supp. 202.

Ulcer disease is one of the strangest and most puzzling diseases known to internal medicine and in addition has an extremely high frequency. For these reasons it is only natural that ulcer disease should have been the object of close study. Numerous theories supported by clinical and experimental data have been formulated to explain the cause of ulcer. Hitherto, however, no satisfactory final answer has been given to the question of the pathogenesis of ulcer disease. It seems, however, to have been proved that ulcer disease is a syndrome, the manifestations of which appear in different parts of the organism and that the peptic lesion in the intestinal canal is only one of the symptoms.

From the clinical facts and experimental data for ulcer disease, liver metabolism and carbohydrate metabolism, a penetrating analysis has been made in order to throw light on the pathophysiology of the disease and thereby decide upon an adequate method of therapy.

According to this analysis, the belief has been expressed that ulcer disease originates in a biological extreme variant and is characterized by a high reactivity in the sympathoadrenergic centers of the hypothalamus with its consequent effect on the individual under stress of external factors which influence the sympathoadrenergic system such as a general disturbance of the metabolism with displacement towards acidity with the following results: gastric hypersecretion, impairment of the homeostatic mechanism of the liver and a disturbed sugar metabolism, direct influence on the alimentary tract with gastric hypomotility, pylorospasm and a general increase in tone of other sphincters together with intestinal atony, a vasoconstriction within the planchic region whereby follows a distalization of the mucous membrane, a direct influence on the marrow of the suprarenal, the adrenal cortex, of which intensifies the other disturbances, a stimulation of parasympathetic centers producing the disturbed sugar metabolism, resulting in a traumatic and postabsorptive fasting secretion and an ulcer secretion.

These last symptoms are facultative, due to the degree of severity of the primary disturbance, and are considered as compensatory.

The combination of these factors produce in the stomach or duodenum the local manifestation of ulcer disease.

With regard for this hypothesis, and on the basis of the knowledge of the pharmacodynamic properties of ergotamine, this substance has been used in the treatment of 115 patients with ulcer. The author's series comprised both ambulatory and clinical patients. The guiding principle has been to give only ergotamine and to dispense with other therapeutic measures, e.g. dietetic restrictions, confinement to bed, etc.

The results of the treatment have been controlled by roentgenograms. In a certain number of cases oral tests have been made of the glucose tolerance before and after treatment. Following treatment with gynergen the patients become rapidly symptom-free. It is easy to treat the ambulatory patients and recurrences can be prevented by immediate intervention as soon as the initial symptoms appear.

HARRY W. FINE, M.D.

#### Primary Nonspecific Ulcers of the Small Intestine

JOHN A. EVERETT B. MARDEN BLACK, and BLAUGOLM B. DOCKERTY *Surgery* 948, 3 85.

Nonspecific localized ulcerations of the jejunum and ileum are so similar pathologically as to justify their classification as a group under the name "primary" or simple ulcers. Although the lesions are characteristically solitary, small groups of ulcers are sometimes found. The etiology of primary ulcers is unknown. There is little direct evidence to support the theories that they are caused by infection, irritation from gastric secretions, trauma, or vascular abnormalities.

The symptoms of primary ulcer are for the most part secondary to the complications of perforation, bleeding, or obstruction. The possibility of these lesions should be considered in the presence of unexplained intestinal bleeding or of peritonitis which suggests acute visceral perforation when such perforation cannot be found in the stomach or duodenum.

The mortality rate in patients suffering from primary ulcer is high. The lesion has been recognized during life only after some complication has led to surgical intervention.

Bleeding Peptic Ulcer CHARLES BAKER. *Gny' Hosp Rep* Lond., 1947 96

The author presents a clinical study of 576 patients with bleeding peptic ulcer who were admitted to the Selly Oak Hospital, Birmingham, England, during the 6 year period from 1940 to 1945. Only those cases in which there was bleeding on or after admission and in which bleeding was from a peptic ulcer were included in the series. If these two points were established no standard of severity on admission was necessary.

The mortality rate was 13.4 per cent. If 5 patients dying as the result of perforation complicated by bleeding are included the mortality rises to 14.1 per cent. Taking into account the undoubted improvement in treatment in recent years, and the greater readiness and ease with which blood loss can be overcome, this figure is undoubtedly high. According to the author two important factors are responsible for this: the large proportion of patients arriving in very poor condition and dying within 24 hours, and the large number of patients in the high age groups. Comparing this mortality record with that of the preceding 6 year period brings up an interesting observation. From the years 1934 to 1939, the mortality from bleeding peptic ulcer was 7 per cent in the same institution. It is possible that the increase in mortality was due to the physical and mental strain of the war and the bombings in Birmingham. Coincident with this increase in mortality from bleeding ulcer there was a concomitant increase in the incidence of peptic ulcer in general.

A review of the time of year at which fatal hemorrhages occurred showed that there was no particular season when this was strikingly common though there was a slight decrease in late spring and early summer. Further analysis of factors underlying the problem of bleeding peptic ulcer indicated that peptic ulcer is not only more difficult to diagnose than duodenal ulcer, but that it is more likely to bleed and cause death from bleeding. This is an important point in prognosis in the individual case.

Treatment varied with each case but, in general, the plan was somewhat as follows: rest, physically and mentally; fluid replacement and blood transfusion for severe loss; early feeding; and if these medical methods fail or seem likely to fail, early recourse to surgery before the general condition deteriorates. Previous writers on hematemesis have deplored the fact that important decisions in cases of bleeding ulcer were left to juniors. In this series the cases have been under the individual care and direction of a small group of three full time physicians so that there is no great divergence in the methods adopted and treatment of the patients in the series is reasonably uniform.

The question of radiography after bleeding is a serious one in until there is a reasonable chance that the bleeding point is healed, the danger of restarting a hemorrhage must be considered. The author believes that the hemoglobin should be at least 60 per cent, the occult blood test negative, and the patient should be well enough to be out of bed before roentgenograms are taken. Six deaths from hemorrhage occurred shortly after roentgenography the interval being 1, 4, 6, 9, and 13 days between roentgenography and the first subsequent bleeding.

To classify the problem of the place of emergency surgery in the treatment of bleeding peptic ulcer was one of the main objects of this investigation. Though the proportion of patients operated upon was small, a comparison between those selected for surgery and those not selected, between successes and failures

seen against a background of a large number treated by medical methods alone yielded some valuable information. The surgical mortality reflects the physician's principles as well as the surgeon's difficulties. There is no more satisfying result than successful intervention for it is the result of combined judgment skill and teamwork.

As the result of an extensive analysis the author has come to the following conclusions regarding the indications for surgery.

Before a decision to operate is considered three essentials must be present: reasonable clinical evidence that a chronic ulcer is present; failure of medical treatment provided this has been adequate; absence of intercurrent disease. Given these three points the indications for operation, apart from definite emergencies such as perforation, seem to be:

1. The presence of an obstructive factor. With associated pyloric stenosis or hour-glass deformity operation should be considered after one severe hemorrhage or persistent bleeding even if minimal.

2. Sudden hemorrhage while under medical treatment for an ulcer if the patient was admitted without bleeding particularly if pain has not been relieved by strict regimen in bed.

3. Recurrent hemorrhage while under good medical treatment for bleeding. After the first attack while under treatment operation should be considered if there is no response within 24 hours to renewed emergency measures. After the second attack it should be considered seriously whatever the response. With succeeding hemorrhages the indication is increasingly strong. The longer the interval between the recurrent bleedings and the better condition in the intervals the longer can the surgery be delayed but the more certain it is that operation will ultimately be needed.

4. Persistent bleeding as indicated by the general condition of the patient even if unassociated with further hematemesis or melena. In these cases delay is dangerous. In the absence of absolute indications for operation, the best time for a decision is the fourth or fifth day and it should not be delayed longer than a week. A reasonable decision can rarely be made in the first 48 hours. The need for operation in acute ulcer seldom arises and a surgeon should rarely be asked to operate on other than a chronic ulcer.

HAROLD LAUFMAN, M.D.

**Treatment of Peptic Ulcer.** RUSSELL S. BOLES.  
*J Am Med Ass.*, 1948, 136: 528.

The author believes there is an immediate need to abolish the term "peptic ulcer." No proof exists that the ulcer is due to peptan. The ulcer itself is no more the disease than an ulcer on the toe is diabetes or Buerger's disease. Hyperchlorhydria does not cause peptic ulcer; rather the ulcer causes hyperchlorhydria, the latter being the result of pylorospasm with food retention and irritation of the gastric glands.

The highly unsatisfactory results of medical and surgical treatment of ulcer can be attributed to the

failure to investigate the influence of social, genetic, environmental, and domestic factors which may be related to the incidence of the disease. There may be present an ulcer diathesis which renders certain types of persons because of psychological and physical characteristics more susceptible to ulcer.

The crux of the ulcer problem is the cell resistance of the gastric mucosa. Cellular resistance probably depends on the state of the circulation in the stomach, and on the chemical composition of the blood reaching the cells. Chronic circulatory insufficiency in the deeper layers of the stomach—possibly the result of blood vessel spasm—exerts a significant influence in ulcer formation. The effect of emotional disturbances on the circulation of the stomach leading to mucosal erosion and hemorrhage have been described. The effect of tobacco in ulcer production may logically be attributed to its action on the end vessels in the stomach and duodenum.

Peptic ulcer is a medical problem. Operations should be reserved for the complications of perforation, hemorrhage, obstruction, and so-called intractability. The unsatisfactory results of medical treatment can be charged to preoccupation with the correction of the chemical environment of the lesion. While acidity may be controlled by rest, diet, and a calm life, healing and recovery appear to be the result primarily of release of pylorospasm and vascular spasm in the gastric vessels.

The employment of extracts, hormones, or other substances by injection for the treatment of ulcer is analogous to the use of insulin in diabetes. Any benefit from such treatment is probably temporary.

The intragastric drip is effective in reducing acid secretion and is well suited to refractory ulcers with a high continuous nocturnal secretion, especially when pyloric spasm is present. The various protein hydrolyzates and amino acids do not exert any specific influence on ulcer as supplements to the diet; they are useful.

That gastric resection is not the answer to the ulcer problem may be suspected from the widely varying statistics concerning its results and the diversity of opinion as to what the method and the extent of the procedure should be. Resection for benign gastric ulcer carries more promise of relief and protection from recurrence than resection for duodenal ulcer. Resection for hemorrhage appears to have little to offer in the general run of cases.

The treatment of ulcer by vagotomy and a consequent reduction in acidity disrupts the secretory and motor mechanisms of the stomach.

A model plan of life for patients with ulcer not only would promote healing but would minimize the risk of complications and recurrence in most cases. It should be undertaken however with the understanding on the part of the patient that infraction of the rules means recurrence. Ulcer should be regarded as an incurable disease. It may be held in check, however, by the cultivation of a new manner of living. In occasional cases in which the ulcer is adherent to other structures or is so sclerotic that no



medical measures can hope to hold promise of recovery surgical intervention becomes necessary. Under these circumstances, it is advisable to perform as conservative an operation as possible.

SAMUEL KAHN, M.D.

**Vagotomy for Peptic Ulcer.** HENRY N. HARRIS and DONALD H. HOOKER. *Surgery* 94:7 239.

The operation of vagotomy for peptic ulcer has been widely used since its revival by Dragstedt and Owens in 1933. The modern procedure differs from most of its predecessors in that it is undoubtedly more complete and is performed only near the level of the diaphragm. Two approaches are used: the transthoracic and the transabdominal.

In the laboratory 5 types of experiments were done. Three of these showed no effect of the test procedure on the incidence of histamine-provoked ulcer in the guinea pig. These negative experiments included transabdominal vagotomy, the administration of aqueous benadryl solution by mouth and the subcutaneous administration of benadryl in beeswax.

Two other types of experiments gave more positive results. Beaver and Mann reported that 3 control Mann-Williamson dogs developed ulcer (100 per cent) whereas of 3 such dogs with supplementary transthoracic vagotomy only 2 developed ulcer (67 per cent). It was thought advisable to repeat this experiment with a larger number of animals. In the authors' series of 3 control Mann-Williamson dogs 11 animals died with ulcer (85 per cent) after from 29 to 161 days following the operation. Two dogs dying 55 and 145 days respectively after the operation had no ulcer. In the series of 9 dogs subjected to the Mann-Williamson operation plus a supplementary transthoracic vagotomy only 1 died with ulcer (11 per cent) 41 days after operation. Six of these dogs died from 28 to 97 days following the Mann-Williamson operation and presented no signs of ulcer. Two additional dogs with the combined procedure were still alive 206 and 430 days respectively after the Mann-Williamson operation. In the control series no animals were included unless they lived at least 4 weeks after the operation.

Shay and associates reported in 1945 that within 15 hours of pyloric ligation rats, which had been previously starved regularly develop multiple hemorrhagic ulcerations of the gastric rumen. In some instances ulcers of the fundus were also observed. The effect of vagotomy on the development of such ulcers has not been previously reported. The vagotomy was done infradiaphragmatically by a modification of the method by which Heymans and Chent used to ligate the nerves to the carotid sinus. Following the operation the animals were either sacrificed at the end of 24 hours or kept alive as long as possible with almost daily injections of from 10 to 15 c.c. of glucose-saline solution. In the control series of 17 rats all of them had ulcerations of the gastric rumen and 7 of them had in addition ulcers of the fundus of the stomach. There was a total of 346 ulcers or an average

of 22 ulcers in the rumen of each rat. Histologically the ulcers were deep, some involved most of the layers of the stomach wall, and there was an associated extensive edema. In the stomach there was an average of 14 c.c. of fluid showing 17 units of free acid and 81 units of total acid. The series of 15 vagotomized rats showed no ulceration of the rumen nor fundus, nor edema of the stomach wall grossly or microscopically. There was an average of 7 c.c. of fluid in the stomach with a free acid of 7 units and total acid of 56 units. As to survival, 6 rats with pyloric ligation alone lived an average of 46 hours, whereas those with a supplementary vagotomy survived an average of 97 hours. Irrespective of whether the lesions produced by pyloric ligation are ulcers or deep hemorrhagic erosions, they are prevented by vagotomy during the time limit under discussion. Diminished gastric volume and acidity are not the only factors concerned in the beneficial effect of vagotomy.

Vagotomy of the modern type was performed on 36 patients with peptic ulcers. The cases fell into several groups so that a variety of procedures were performed in association with vagotomy. However, the authors state that it can be said very tentatively that the vagotomies performed with shunts or gastric resections have on the whole given better results than those when no complementary procedure was performed. They classed 4 cases in the series as clinical failures because the insulin test was negative and another operation was necessary. In 3 of these the vagotomy was not complete. In 3 of the patients ulcers were found.

The triad of symptom changes following vagotomy are relief of pain, relative diarrhea, and delayed gastric emptying. EDWIN W. PAMARILLI, M.D.

**Experiences with Vagotomy for Peptic Ulcer.** RICHARD WARREN. *Surgery* 94:7 246.

A series of patients was studied in a large veterans hospital. The incidence of peptic ulcer over a 3 year period was 6.7 per cent. This figure is considerably higher than that reported from civilian hospitals. The highest figure in the literature on the incidence of peptic ulcer among admissions to civilian hospitals is 4 per cent. The probable explanation for this is that in the veterans hospital there is an exclusively male population.

Vagotomy was performed on 15 patients with duodenal or stomach ulcer. Patients for operation were selected largely on the criteria of Dragstedt and of Moore and associates: young patients, uncontrolled by medical therapy, who had a high degree of stress sensitivity, a gastric secretion high in acid and a copious amount of night secretion, and who presented no problem of cicatricial pyloric obstruction. These criteria were expanded to include other patients who needed surgery for duodenal ulcer. In order to maintain a consistent policy in their first cases, the following were used as contraindications for inclusion in this series: recent massive hemorrhage in patients over 45 years of age or active bleeding at the

time of surgery at any age diagnostic uncertainties produced by conflicting roentgenograms obviously poor mechanical situations resulting from ill-adviced previous surgery and pyloric obstructions. Under these criteria may be included some of those intractable cases in the middle age group without copious night secretion and others with chronic alcoholism Buerger's disease and psychoneurosis.

The transthoracic route was used in all but one case and the Moore modification of Dragstedt's technique was employed. The early complications noted following operation included minor atelectasis in one patient and contralateral pneumothorax and mediastinal emphysema in another. Ten patients had considerable postoperative hyperpyrexia from 101 to 120 F for 3 or 4 days. Most of them had annoying postoperative chest pain. One developed subdeltoid bursitis. Three patients developed symptomatic postoperative gastric retention. Two of these had one episode of vomiting. The third suffered exacerbation of a duodenal ulcer and developed 2 gastric ulcers in addition. The results of operation show that after recovery from the complications all but 3 of the patients are clinically well from 1 to 8 months postoperatively. Of the 3 have a gastric retention manifested by vomiting once or twice a week. The third patient is the one with flare up of the duodenal ulcer and the additional gastric ulcers. A successful gastric resection was done 7 weeks after vagotomy.

The author discusses the latter case in detail. This patient had Buerger's disease and a mild addiction to alcohol in addition to his ulcer. Following vagotomy the patient did very well for 3 weeks. Evidence of adequate vagus interruption was shown by the insulin test; however the fasting acidity was higher than before operation. Clinical symptoms supervened in a short time and gastric resection was performed 7 weeks after vagotomy with complete success. The specimen showed 2 gastric ulcers and no evidence of disease of the arteries.

A theoretical explanation for this situation is offered. It being kept in mind that changes occur following vagotomy and also that vagotomy will cause gastric ulcers almost routinely in the rabbit and occasionally in the dog and monkey. Because of vagotomy the importance of the cephalic phase of gastric secretion has been greatly emphasized. It is logical to suppose that there are patients with peptic ulcer whose hyperacidity is the result of the gastric phase of gastric secretion. Neutralizing factors in patients with hypersecretion are the gastric mucus and the regurgitated alkaline duodenal juice. Although Ferguson has shown there is some mucus still present in the juice of a vagetomized stomach, Babkin has demonstrated that the vagus juice is moderately rich in mucus whereas the histamine juice has little. It is undeniably possible that in certain ulcer patients the gastric phase of gastric secretion contributes more to the hyperacidity than the cephalic phase. In these patients removal of some of the alkaline mucus by vagotomy especially

if there were enough pyloric obstruction to prevent duodenal regurgitation might render the gastric mucosa more vulnerable to ulceration.

EDWIN W. PASSARELLI, M.D.

#### The Operative Treatment of Chronic Gastric and Duodenal Ulcer. CHRISTIAN BRUNGAARD. *Surg* 1948 23 161

The authors experience with the surgical treatment of chronic gastric and duodenal ulcers is reported. Gastrojejunostomy was performed on 416 patients with a mortality rate of 4.7 per cent, while partial gastrectomy was employed in 572 patients with a mortality rate of 4 per cent. Brungaard believes that gastrojejunostomy should not be used as the routine method for the treatment of chronic gastric and duodenal ulcers. Partial gastrectomy is the therapeutic method of choice for these lesions. In patients with duodenal ulcer who are over 60 years of age, gastrojejunostomy yields the same results as partial gastrectomy. Gastrojejunostomy is especially useful for patients in this group whose general condition is poor or in whom technical surgical difficulties are encountered which might increase the operative risk.

ROBERT TURELL, M.D.

#### Thirty Nine Cases of Total Gastrectomy (A propos de trente-neuf observations de gastrectomie totale). R. DE VERNEJOUL. *Lyon chir* 1948 43 17

In a great number of articles published during the last 15 years in different countries, the postoperative mortality of total gastrectomy varied from 14 to 60 per cent. The author discusses a series of 39 of his own cases. 30 of the patients had carcinoma, 4 juxta-cardiac ulcer and 5 recurrent peptic ulcer after one or two preceding gastrectomies. Ten of these patients died immediately after surgery, 6 developed recurrences or metastases and 1 was lost to sight. Twenty-two are living 12 for more than a year after the operation.

In the patients who survived the operation, an initial period of gastro-intestinal disturbances (diarrhea, nausea, vomiting) was followed by good adjustment, hearty appetite, and gain of weight. The digestion of protein and carbohydrates appears normal whereas the assimilation of fat is not satisfactory according to many authors. Development of pernicious anemia due to gastrectomy has not been observed in any of the author's cases.

The questions of indication and surgical technique are discussed briefly. The main indication is carcinoma, whereas in cardiac ulcer and in recurring peptic ulcer vagotomy may be preferable as an alternative. As to technique the author prefers the method of Lefevre after resection of the xiphoid cartilage a loop of jejunum is sutured to the inferior surface of the diaphragm and the afferent part is used as a pentoneal sac which covers the site of the anastomosis from all sides. This procedure prevents disunion of the sutures and leakage at the anastomosis with ensuing fatal peritonitis which is the principal danger. WERNER M. SOLMITS, M.D.

**The Gastric Secretion after Subtotal Gastrectomy for Ulcer. A Study Comparing the Reduction of Secretion after Gastrectomy and after Vagotomy (Sécrétion gastrique après gastrectomie subtotale ou vécotomie. Etude comparée de la réduction de la sécrétion après gastrectomie et après vécotomie).** P. SARTY, P. MARROW, J. MELEY and S. SCHWOCK. *Lyon chir.* 1948 43 60.

Most statistics report that after subtotal gastrectomy the secretion of hydrochloric acid usually stops and the gastric juice reveals achlorhydria.

The authors, in a series of 31 cases, obtained less favorable results. In 16 (52%) of their cases the gastric stump secreted hydrochloric acid, either in the fasting patient or after the injection of histamine. In order to obtain correct results it is important to make sure that the sample of gastric juice does not contain bile. The reflux of bile into the stomach may falsify the picture as bile neutralizes free acid. Furthermore, it is important not only to perform the test immediately after the operation but to repeat it some months later. Several cases are on record which showed absence of free acid shortly after the operation but recurrence of acidity months or even years later.

The volume of gastric juice is reduced by about 50 per cent after subtotal gastrectomy; the average hourly volume being 133 c.c. before, and 76 c.c. after the operation.

The authors believe that recurrences of peptic ulcer after subtotal gastrectomy can occur only if the stump secretes free acid. Six of their cases were of this kind.

On comparing the results of bilateral vagotomy with those of subtotal gastrectomy the authors found that the decrease in the volume of gastric secretion is about the same after both procedures, but the reduction of free acid is more marked after gastrectomy. The two methods may be combined in appropriate cases in order to prevent or to treat postoperative peptic ulcer.

WALTER M. SCHWARTZ, M.D.

**Intestinal Ulceration Due to Arterial Necrosis (Malignant Hypertension and Polyarteritis Nodosa).** S. DE NAVARRE and E. B. FRIEDMAN. *G. S. Hosp. Rep. Lond.*, 1947 96 85.

Intestinal ulcers are uncommon manifestations of arterial necrosis due either to malignant hypertension or to polyarteritis nodosa. The authors present 3 cases in which the clinical picture indicated predominantly intestinal involvement.

The first case was that of a young female, age 23 with a short history of 2½ weeks' illness with intestinal hemorrhage and malignant hypertension. Sudden collapse of the patient was due to hemoperitoneum, but she died before a laparotomy could be performed. Postmortem examination revealed irregular serpentine ulcers in the lower portion of the ileum. Microscopic examination of the ulcerated areas showed denudation of the mucosa and submucosa and interruption of the muscularis mucosae,

which were replaced by a fibrinocellular exudate. The small arteries and arterioles of the submucosa showed every degree of change from an acute inflammation of the adventitia and media to complete necrosis of the entire wall, the vessel being reduced to a mass of fibrin containing nuclear debris and an occasional leukocyte. The same lesions were found in the kidneys, but were far fewer in number.

The second case was that of a female, age 51, with a 3 months' history of diarrhea and a spuelike syndrome. Despite transfusions and medical treatment for a severe anemia, the patient died. At autopsy the ileum showed ulceration of varying depth, from superficial necrosis and desquamation to disappearance of the entire mucosa and submucosa. This was accompanied by an inflammatory reaction in the underlying wall which varied from an acute fibrinocellular exudate to a chronic granulomatous reaction which caused thickening of the wall. The inflammatory reaction was predominantly vascular, being related to corresponding changes in the arteries, arterioles and venules. There was necrosis of the vessel wall involving particularly the media and adventitia and occasionally the intima. In the most severe examples the vessel was replaced by a ring of amorphous eosinophilic material containing nuclear debris and surrounded by leukocytes. The jejunum was less severely affected and the lesions were more granulomatous in type. The spleen showed numerous foci of ischemic necrosis. In some of these the eosinophilic outline of necrotic vessels could be seen, while in others of more recent date a necrotizing arteritis was present. A similar type of necrosis was found in the mesenteric lymph glands.

HAROLD LAUTMAN, M.D.

**Cancer of the Rectum.** FRED W. BAXTER and COLLEMAN C. JOHNSON. *J. Am. Med. Ass.* 1948, 35: 371.

Rectal cancer is easily diagnosed and radical surgery offers the most favorable prognosis. There is considerable controversy over the type of procedure most acceptable in the majority of cases. Miles made the greatest contribution in this field of surgery and an improvement on the combined abdominoperineal resection has yet to be found.

Many procedures have been developed for the preservation of the anal sphincter but in the light of recent anatomic studies of the lymphatics of the perirectal and pelvic tissues these are of little value.

The grade of malignancy of the lesion and the presence or absence of glandular involvement exert a profound influence on prognosis. Hence, the basic surgical principle should be to use as radical an operation as possible with widespread removal of gland-bearing tissue.

The secret of adjusting to an abdominal colostomy is the realization that this is the safest method of insuring longevity. Uncertainty on the part of the surgeon that a colostomy is essential leads to hesitation, dissatisfaction, and maladjustment. Careful explanation prior to surgery, early routine colostomy care, and firm instruction and encouragement do

much to hasten the psychic readjustment of even the highly emotional and unstable patients.

The authors favor the Miles combined abdominoperineal resection in one stage because (1) it permits ligation of the blood supply to the pelvis before the pelvic dissection is carried out (2) it permits wide spread removal of gland bearing tissue in all zones of spread and (3) it gives a higher percentage of 3 and 5 year cures and more freedom from recurrence than any other procedure. The authors discuss the disadvantages of other less adequate procedures.

Preoperatively the nitrogen, caloric, and electrolyte balance should be restored as the patient's physiologic reserve is important in keeping down mortality. Careful preoperative bowel irrigation, sulfanamide transfusions, vitamins and penicillin are used routinely.

The authors review their experiences with 336 cases of rectal cancer. Seventy five per cent of the patients were resectable and in 167 the one stage combined abdominoperineal resection was carried out with a mortality of 5.3 per cent. The 5 year survival rate was 52.4 per cent. Glandular metastases were found in 73 patients. 89 had no glandular involvement. The former group had 2 times the number of 5 year survivors that the latter group had.

There was a high incidence of death due to small bowel obstruction. The authors stress this complication. They urge early reoperation.

Early diagnosis to increase the rate of resectability is the present goal. ROBERT R. BIGELOW, M.D.

#### Carcinoma of the Rectum and Rectosigmoid. A Statistical Analysis of 844 Cases. RALPH A. THOMAS, PHILIP S. KLINE, and LINDON SEED. *Arch Surg.*, 1948, 56, 92.

The authors reported a statistical analysis of carcinoma of the rectum and rectosigmoid in 844 men who were admitted to the Veterans Administration Hospital, Hines, Illinois from 1931 to 1946. The frequency of the most important symptoms in 400 of these patients expressed in percentages is as follows: (1) bleeding 76.5, (2) loss of over 10 pounds in weight 67.2, (3) diarrhea 40.5, (4) pain in the rectum 24.7, (5) constipation 23.2, (6) abdominal pain 12, (7) small stools, 5.2, (8) alternating constipation and diarrhea, 5.1 and (9) acute obstruction 3 per cent.

Bleeding as the first symptom occurred in 36 per cent of the cases. Twelve per cent of the 400 patients had had antecedent treatment for hemorrhoids, most of them having undergone hemorrhoidectomy. Internal and external hemorrhoids are believed to be the result of obstruction of venous drainage produced by the cancer high up in the rectum. Parenthetically, with few exceptions the rectal malignant lesion in these cases can be recognized on digital examination alone.

Loss of weight, contrary to the general opinion, occurs early in the course of the disease.

A change in bowel habits in the form of either diarrhea or constipation or both was present in 73.8

per cent of the patients, the diarrhea being more frequent than the constipation. A history of alternating diarrhea and constipation, a supposed frequent accompaniment of rectal cancer, was obtained in only 5.1 per cent of patients.

Abdominal pain, usually attributed to partial obstruction was found in 12 per cent. In 2 patients appendectomy was performed for this type of pain.

In the decade from 1931 to 1940 the duration of symptoms from the alleged time of the onset of illness until the patient presented himself for examination was 11.3 months. In the period from 1940 to 1946 the time interval dropped to 9.7 months. The median for both groups was about 7 months, that is one half of the patients presented themselves before, and the other half after the symptoms had persisted for 7 months. There is little correlation between the duration of symptoms and operability and resectability of the lesion. The duration of symptoms was practically identical for the various age groups.

There were 13 anaplastic or undifferentiated carcinomas and 743 adenocarcinomas. There were 10 malignant polyps which also showed adenocarcinoma. The authors surmised that many more adenocarcinomas had their origin in a pre-existing polyp. The incidence of epidermoid or squamous cell cancer was low — 0.7 per cent.

The authors reported a doubling of the resectability rate which began in 1940 and was accompanied with a sharp reduction in mortality for all procedures. This improvement is ascribed to increased surgical experience and better preoperative preparation with special reference to the maintenance of the fluid, electrolyte and protein balance, the more liberal use of blood and plasma, and the use of the sulfonamide drugs and antibiotics in the control of infections.

Colostomy prolongs the life of the patient who has an obstructing lesion but it does not prolong life much beyond that of the patient with a nonobstructing lesion. Adequate irradiation prolongs life and should be used as a palliative procedure and as a prophylactic postoperative measure. Patients surviving abdominoperineal resection had a 45.5 per cent chance of living 5 years. There is little difference between the survival curve for the two stage perineal excision and that for abdominoperineal resection for the first year, but after that the latter procedure is at a higher level. Patients surviving a perineal excision had a 32.1 per cent chance of living 5 years.

As a result of their studies the authors believe that carcinoma of the rectum or rectosigmoid should be adequately resected. The operation should be carried out even in the most adverse circumstances.

ROBERT TOWELL, M.D.

#### The Closure of Colostomies. GEORGE B. SANDERS, HEINZ HARTNER, and ROBERT B. LYNN. *Ann Surg.*, 1948, 127, 243.

Experience with 72 consecutive colostomy closures has resulted in a decided preference for a method of colostomy closure which will provide

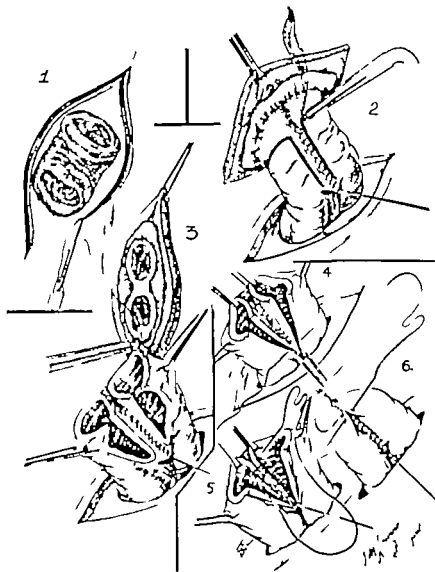


Fig. 1 (Sanders *et al.*) Patchet technique of colostomy closure. Cautery is not used in modification of this procedure. Colostomy stoma and adherent skin cuff are excised. Vertical incision in long axis of each lower limb is made also. The incisions from the stoma extend instead of as shown. The continuous suture shown is usually continued down the lateral aspect of the anastomosis as continuous Connell's stitch. Interrupted Halsted sutures of fine black silk are substituted for continuous Lembert suture shown. (Reproduced in *A Guide to Surgery* by permission of publisher from Malinger *Abdominal Operations* D Appleton Century Co. New York)

As early anatomic a reconstruction of the colon and abdominal wall as is possible namely an intraperitoneal type of closure

2. A technique of closure which of itself with the passage of time and the not too remote dangers of finding a preliminary spur crushing procedure.

3 A type of intestinal anastomosis which will allow the surgeon considerable freedom in suturing so that he may make a two-layer or even three-layer

closure of great firmness, turning in a sufficient cuff of bowel wall to ensure excellent peritoneal coaptation yet at the same time leaving a sufficiently large lumen at the site of closure which will not under any circumstances become stenotic due either to immediate postoperative edema, or to its later occurrence from cicatricial contraction.

In the main end-to-end anastomosis, with or without actual resection of the colostomy itself satisfies

these requirements fairly well. Nevertheless it has been the authors' experience in a significant number of cases that with this method immediate postoperative edema has sufficiently compromised an otherwise adequate lumen so as to endanger the integrity of the suture line or to cause postoperative discomfort, cramps and other nuisances. Consequently, their decided preference is for the Pauchet type of closure which they have come to employ almost exclusively for the closure of colostomies in the transverse, descending and sigmoid colons. In their experience with this type of closure, withholding of food postoperatively is unnecessary, postoperative discomfort is minimal and early ambulation is accomplished readily. Wound infection, leakage or failure of the closure and obstructive symptoms, either early or late, are thus far unknown.

JOHN J. MALONEY, M.D.

### LIVER, GALL BLADDER, PANCREAS, AND SPLEEN

**A Study on the Abolition of the Sphincter of Oddi**  
(Studio sull'abolizione dello sfintere di Oddi) MARIO  
NEGRI and GUIDO CASTRINI *Arch. ital. chir.*  
1947 69 385-392

A review of the literature discloses that there are divergent and even contradictory opinions regarding the anatomy and physiology of the sphincter of Oddi.

In 1651, Glisson supposed that there was a contractile muscular ring at the end of the common duct when he found that a sound became obstructed at this level. Gage in 1879 first described a sphincteric apparatus in the cat, but it was in 1887 that Ruggero Oddi gave the first exact and exhaustive description of a muscular ring in the dog, which he interpreted as an independent sphincter, finding the same formation in further research on other animals and man.

The concepts of Oddi were disputed in 1898 by Letulle and Nattan-Larrier, who denied the sphincteric ring. However, the work of Mann in 1927 and of Chiodi in 1933 fully confirmed the conception of Oddi—that there was an independent sphincteric formation at the terminal portion of the common duct.

The sphincter of Oddi presents notable variations in various species of animals both as to development and intrinsic morphology. Morphologically, the sphincter of Oddi may be considered as being constituted of two concentric muscular strata of different origin: an internal stratum which represents the fibromuscular tunic of the choledochus proper and a more external layer derived from the musculature of the duodenum. In certain animals like the dog, the two are well differentiated, but in others like the ox, and likewise in man, there is an intimate fusion between the two. In man the sphincter of Oddi is represented by a robust muscular ring which surrounds the common duct before its penetration into the duodenal wall and accompanies it as far as the ampulla.

According to Hendrickson there are also longitudinal fibers which run parallel to the long axis of the common duct and extend to the papilla, by the contraction of these fibers a retraction of the ampulla is produced. This was confirmed by Helly in 1929. In 1931 Balli attributed an antagonistic action of these fibers to that of the circular fibers.

As to the physiology, there is also much disagreement. Auster, Crohn and Burget maintain that the duodenal musculature is the great factor and deny that the sphincter of Oddi is able by itself to act as an independent and sufficient sphincter. Coffey on the other hand maintains that it can.

The bile is secreted continuously by the liver and then intermittently excreted into the duodenum. It is logical to assume then that the gall bladder serves in a secondary capacity and that the tone of the sphincter of Oddi conditions the factors necessary for the filling and emptying of the gall bladder.

Experiment on animals show that fats and proteins relax the sphincter and drain bile, while carbohydrates seem to have no decisive action. Alkaline substances increase the pressure in the common duct while acid cause a relaxation, as does magnesium sulfate (Meltzer and Lyon).

Oddi has demonstrated the existence of special nervous ganglia in the vicinity of the sphincter which were independent also as to morphologic characters from the intestinal plexus of Auerbach and Meissner.

The drug action on the sphincter is more or less accepted by all workers on the subject. Thus atropine relaxes the sphincter and causes a rapid fall in pressure in the common duct. Amyl nitrate, trinitroglycerin and the glyhyline cause the same result but to a lesser degree. On the other hand morphine, cocaine, pantylin and disaludid cause a spasm of the sphincter with increase in pressure. The drug action establishes the type of nerve supply to the sphincter. From these physiologic studies, contrary to the classic ideas of Donovan it results that the sympathetic nerves inhibit the tone of the smooth muscle of the choledochus and that the pneumogastric nerves reinforce it and their action is identical for the sphincter of Oddi.

The importance of the sphincter of Oddi in the process of bile excretion was established by Meltzer and Westphal in 1921 and by Sakurai in 1927. These authors consider the last portion of the common duct to have two distinct portions: one part which runs behind and through the wall of the duodenum, called the "portio duodenalis" and a second part lower down with sphincteric action constituted by the muscular ring of the papilla of Vater, pilorus. When the sphincter is closed the portio duodenalis is relaxed and filled with bile, and when the latter contracts the sphincter is relaxed and the bile is ejected into the duodenum.

A final and important function of the sphincter of Oddi is to prevent ascending infection as seen when cholecystogastrostomy or enterostomy is performed.

The authors next observed the repercussions in the mechanics of the biliary tree following the abolition

of the function of the sphincter of Oddi. Work along similar lines by Burget in 1929, Mallet-Guy, Auger and Croizat in 1933, Brendolon, Romeo, Bogetti, and Braco, and Colp and Doubilet is reviewed.

The authors then decided to proceed with experiments, using medium and large sized dogs. This animal was chosen because its sphincter is well developed. Four different types of procedures were followed. In the first, a simple section of the sphincter was performed through a longitudinal duodenotomy following a grooved sound as a guide. In the second type drainage of the common duct was done with a rigid tube of caudex according to the method of Stropeni. The tube was allowed to come through the lateral duodenal wall and then run along the mesenteric margin. This was fixed with sero-serous sutures in such a way as to obtain a tunnel in the duodenal wall. A new opening in the duodenal wall in the third portion then allowed the end of the tube to drain into the intestinal lumen. The length of the canal was 5 or 6 cm. In the third type suppression of the sphincter action associated with duodenal exclusion and gastroenterostomy was effected. The fourth type consisted of simple section of the sphincter and cholecystectomy.

Eighteen dogs, varying from 4 to 12 kgm. in weight, were used. Three died of varying causes and were excluded from the results. The remainder were sacrificed at varying intervals from several days to some months. A description of each dog and the results obtained are given as well as the postmortem radiologic, and histologic findings. The conclusions from these experiments are as follows:

1. Following the abolition of the sphincter of Oddi in dogs, a transitory dilatation of the extrahepatic biliary ducts develops. This is at its height on the fifth or sixth day and then progressively diminishes and finally disappears.

2. This dilatation is very similar to a nervous mechanism in its character and behavior.

3. The dilatation of the extrahepatic biliary ducts is always accompanied by an ascending enterogenous infection of mild degree which is limited to the extrahepatic tract and does not alter the hepatic function or general condition.

4. The association of cholecystectomy with abolition of the sphincter of Oddi impedes the dilatation of the extrahepatic ducts, a dilatation often found after simple cholecystectomy.

5. Following abolition of the sphincter of Oddi there are no findings which can definitely be interpreted as showing altered function of the biliary tree, nor do they show an inactivation of the gall bladder.

LOUJAN J. FROMMELT, M.D.

#### Carcinoma Involving the Common Bile Duct. II. E.

LESTER. *Surgery* 1947 36 7

Cancer of the common bile duct produces symptoms early and supposedly develops metastases late. Despite this, most patients eventually die of recurrent cancer and those who do not die of the cancer succumb to repeated attacks of cholangitis. The

avoidance of ascending liver infection which so commonly follows plastic procedures and reimplantation of the common bile duct is a major problem that is not yet solved.

The author presents 4 cases in which resection of the choledochus was performed for carcinoma. In 3 of these segmental resection was done and in 1, a one-stage duodenopancreatectomy was done. Both of the segmentally resected patients died 9 months following operation with symptoms of cholangitis, those with duodenopancreatectomy survived 19 months and 7 months, respectively, both had symptoms of metastasis and cholangitis. Autopsies were not performed.

FRANK B. QUIGLEY, M.D.

#### Contributions to the Knowledge of Pancreatic Reflux as an Etiologic Factor in Chronic Affections of the Gall Bladder. An Experimental Study

FAUX H. *Ann. Chir.* 1946 947 66, Supp. 31

The original suggestion for this investigation occurred a few years ago in connection with an abdominal operation for an acute condition in a patient who presented clinical symptoms of peritonitis. At operation, 300 ml. of bile-colored fluid were found within the peritoneal cavity, evidently emanating from the greatly distended, edematous, and cyanotic gall bladder the wall of which was moderately thickened. No macroscopically observable perforations of the gall bladder or of the extrahepatic bile ducts were recognized. In addition to several hundred calculi, the gall bladder contained dark, slightly cloudy bile which on bacteriologic examination proved to be sterile. This fact in conjunction with the digested appearance of the gall bladder suggested the possibility of a pancreatic ferment as the cause of the disease. In all probability this was a relatively rare disease which in the literature, is termed nonperforative bile peritonitis. Clinical observations and experimental studies have shown that the disease is caused by a reflux of pancreatic juice to the gall bladder. It seemed obvious therefore, that pancreatic ferment may be a possible etiologic factor also in chronic affections of the gall bladder.

The stereotyped pathologic-anatomic pictures in chronic cholecystitis and the fact that in this disease the gall bladder bile often is sterile, are the 2 phenomena which suggested that a pancreatic ferment may be the cause of chronic cholecystitis. With regard to the formation of calculi, it was established long ago through studies on the morphology of the gall stones, that the center of the gall stones often consist of a nucleus made up of more or less necrotic epithelial cells, mucus and bacilli. The origin of these cells may be traced to the gall bladder epithelium which has been subjected to the desquamative proteolytic process described by Martenson (1941) and considered to be the initial stage in the formation of calculi. It is quite obvious that, among the pancreatic fermenta the trypsin (activated) must be the enzyme which would cause this change as well as other possible changes in the gall bladder wall.

efflux of pancreatic juice to the bile ducts can be cause of chronic diseases of the gall bladder only in as far as this process relatively often is rendered possible by the conditions of the openings of the pancreatic duct. The objective of the author was study of the anatomic communication facilities reflux of pancreatic juice in man, based on a pathologiccoanatomic investigation.

An investigation on the presence of pancreatic contents in the gall bladder bile in man in connection with cholecystectomy has been carried out in an attempt to prove that reflux of pancreatic juice actually occurs. Further an investigation was made in animals in order to ascertain whether and to what extent, trypsin causes pathologiccoanatomic changes in the gall bladder wall and possibly the formation of calculi.

Reflux of pancreatic juice can on the whole occur on condition that the anatomic relationship between the pancreatic and the bile duct renders it possible. A brief survey is given of the very conflicting results obtained by various investigators with regard to the relationship between the bile and the pancreatic duct. Also an account is given of a pathologiccoanatomic study by the author on the openings of the ducts in man. The method applied is discussed. One hundred patients (50 men and 50 women) were examined and cholangiographic studies of 430 patients were made with regard to the visualization of the pancreatic duct. On the basis of the results achieved the following conclusions are drawn: (1) possibility of an anatomic communication between the pancreatic and common duct exists in  $86 \pm 3.5$  per cent. (2) visualization of the pancreatic duct by means of cholangiography occurs in  $46.7 \pm 4.4$  per cent, which must be regarded as a minimum figure, the reasons for which are stated. (3) Santorini's duct in open communication with the duodenum occurs in men in  $44 \pm 7$  per cent and in women in  $14 \pm 4.9$  per cent the difference of  $30 \pm 8.5$  per cent is significant and has not been observed previously. The explanation of the preponderance of biliary affections in women may be sought in this anatomic difference between the sexes.

Previous investigations on the presence of pancreatic ferments in the bile ducts in man are surveyed. The author's material includes 100 cholecystectomized gall bladders, the contents of which have been examined for diastase according to Norby's method. 15 of these gall bladders show from 0.06 to 11 activity units of diastase per milliliter of bile. The derivation of this ferment is discussed with regard to cells and bacilli occurring in the bile, the liver as a possible source, secretion of diastase via the blood or lymph passages and inflow of duodenal juice through the duodenal papilla, all of which have been considered improbable sources. The author infers that the recognized ferment must originate from the pancreas through reflux. This theory is supported by the fact that the pancreatic duct was visualized in 6 out of the 9 patients examined by means of cholangiography.

In view of the stereotyped pathologiccoanatomic pictures in chronic cholecystitis and the fact that in this disease the gall-bladder bile as well as the gall bladder wall are remarkably often sterile the author has presumed that the pancreatic trypsin would be the causative factor. Morphologic studies of gall stones have revealed that they contain a central nucleus consisting of necrotic cells, mucin and bacilli. It may be presumed that lesions on the gall bladder epithelium caused by trypsin are the origin of these cells.

Previous experimental investigations on lesions of the bile ducts caused by pancreatic ferments are also surveyed. These are chiefly concerned with acute lesions. The author reports the results of his experimental study on chronic affections of the gall bladder caused by trypsin. 31 rabbits were used, 10 of them as control animals, and the method is described. Of the 21 animals in which trypsin was injected into the gall bladder 20 presented more or less advanced pathologiccoanatomic changes in the gall bladder manifested by chronic cholecystitis. These changes are similar to the changes occurring in chronic cholecystitis in man. Ten experimental animals also presented firm concretions. The control animals in which inactivated trypsin was injected into the gall bladder but which were otherwise subjected to exactly the same treatment as the experimental animals presented no remarkable changes in the gall bladder wall with the exception of pathologiccoanatomic pictures of very mild chronic cholecystitis in 2 instances. On the basis of the result of the experiment the author makes the following inference:

1. Active trypsin injected into the gall bladder of a rabbit with simultaneous occlusion of the cystic duct will after 5 weeks to 13 months produce pathologiccoanatomic pictures of more or less pronounced chronic cholecystitis.

2. These changes in the gall bladder are associated with the formation of calculi in some instances.

3. Inactivated trypsin injected into the gall bladder of a rabbit under similar experimental conditions causes no remarkable pathologiccoanatomic changes in the wall.

4. The diagnosed pathologiccoanatomic changes in the gall bladder reproduce very strikingly the different stages of those pathologiccoanatomic changes which occur in the so-called chronic stone gall bladder in man.

5. That the chemical structure of the experimentally produced calculi does not completely conform to that of gallstones in man must be considered to be of secondary importance in comparison to the general recognition of such bodies especially as spontaneously developed biliary calculi were never diagnosed in the experimental animal used and therefore it must be presumed that this animal lacks the capacity for the formation of biliary calculi, a condition which may perhaps be explained by the fact that the pancreatic and common ducts open separately in this animal.



Physioclinal aspects of pancreatic reflux conclude the study  
BENJAMIN GOLDMAN, M.D.

**Chronic Recurrent Pancreatitis: A Clinical Study of 20 Cases.** SAMUEL N. MAIMON, JOSEPH B. KIRSNER, and WALTER LINCOLN PALMER. *Arch. Int. Med.* 1948, 81, 56

Because the entity chronic pancreatitis is seldom considered clinically, the authors have reviewed the significant manifestations as observed in 20 cases.

Bouts of severe pain in the upper abdomen are the most frequent and outstanding complaint. The importance of considering the possibility of pancreatitis in the treatment of patients with pain in the upper part of the abdomen following operation on the biliary tract is evident, and careful exploration of the pancreas is emphasized especially when laparotomy done for signs of biliary colic, fails to disclose gall stones. The difficult differentiation between benign and neoplastic lesions is discussed.

For aid in establishing the diagnosis of chronic pancreatitis the following facts are tabulated:

The physical findings are indefinite and jaundice may occur in the absence of calculi. The biliary tract when pancreatitis is present. Among 8 cases in which the serum amylase was determined it was found elevated in 3 of them, normal in 4, and decreased in 1. The oral glucose tolerance curve which shows a diabetic type of curve is of help in the diagnosis. Pancreatic calcifications are not infrequent roentgenological findings. Disturbance of carbohydrate metabolism was frequent and steatorrhea not uncommon in this series.

The fact that half of the patients in the series had had previous surgical treatment for the biliary tract suggests that pancreatitis must be considered in patients with continued pain following cholecystectomy.

In summarizing the surgical results the authors state that surgical intervention gives good results in patients with obstruction of the common duct and in those with constriction of the duodenum. Removal of ductal calculi frequently relieves pain, while steatorrhea may be favorably affected. An established diabetic state tends to remain unaltered.

W. FOSTER MONTGOMERY, M.D.

**Carcinoma of the Gall Bladder.** FRANK P. SAINBURG and JOHN H. GARLOCK. *Surgery* 1948, 3, 30

The authors believe that cancer of the gall bladder is not of infrequent occurrence, some published reports to the contrary notwithstanding. Between the years of 1933 to 1946 inclusive there were encountered 75 individuals with cancer of the gall bladder at the Mount Sinai Hospital, New York, New York. The diagnosis was verified histologically in 65 patients after operation and in the remaining 10 at necropsy (5 of the latter 10 individuals were moribund on admission to the hospital while the remaining 5 died of unrelated disease). Of the 65 patients who underwent surgery only one patient was alive over 13 years following operation for supposed chol-

ecystitis, death of the remaining 64 patients occurred within 35 months after operation.

The sex incidence showed a ratio of 5.3 women to 1 man. The cardinal symptoms were abdominal pain especially in the right upper quadrant, in 77.3 per cent; loss of weight in 41 per cent; jaundice in 38.6 per cent; and a palpable mass in the upper quadrant of the abdomen in 64 per cent. The pathologic observations at operation varied from a picture suggestive of cholecystitis to a totally inoperable new growth involving many abdominal organs in some cases. In 7 patients in whom cholecystectomy was performed for suspected cholecystitis, the pathologist reported unsuspected carcinomas.

The histologic diagnoses were as follows: adenocarcinoma (83.7 per cent), squamous cell carcinoma (4 per cent) and unspecified carcinoma (13.3 per cent). Concomitant cholelithiasis was encountered either at operation or at autopsy in 73.3 per cent of the patients. Refined stones were found in association with carcinoma in 2 cases following an anteceded cholecystectomy. The high incidence of association of cholelithiasis with carcinoma suggests that stones may be a precursor of carcinoma of the gall bladder. This assumption is supported by clinical (Graham, Kirschbaum, and Kosoff, Warren and Balch and Finney and Johnson) and experimental (Kasama and Leitch and Petrov and Krotkine) studies. That the reverse is not probable, that is, that stones are not produced by the malignant process, was pointed out by Graham who found an incidence of only 8 per cent of stones in metastatic carcinoma of the gall bladder.

Sainburg and Garlock believe that cholecystectomy for silent or symptomatic cholelithiasis is a sound prophylactic measure against the occurrence of neoplastic transformation which when diagnosed clinically is virtually an incurable disease.

R. ARTHUR TURELL, M.D.

**Splenic Tissue in the Scrotum.** ERLAND SARTOR. *Acta chir. scand.*, 1948, 96, 388.

The author reports the case of a patient with ectopic splenic tissue in the left half of the scrotum. He cites earlier publications (5 cases) and discusses the genesis of this anomaly. In the differential diagnosis of tumors located in the left half of the scrotum, the possible existence of such accessory splenic tissue should be borne in mind.

JOHN J. MULLONY, M.D.

## MISCELLANEOUS

**Syndrome of an Acute Condition of the Abdomen Caused by Spontaneous Extraperitoneal Rupture of the Retroperitoneal Blood Vessels (Les syndromes abdominaux aigus par rupture spontanée sous-péritonéale des vaisseaux rétro-péritonéaux.)** J. LAFERRÈRE. *Rev. chir. P.* 1947, 66, 246, 282, 368.

The author discusses 16 cases collected from the literature in which the rupture of a retroperitoneal vessel produced the clinical picture of an acute con-

of the abdomen. Except in 3 cases of arterio- of the aorta, the hemorrhage was caused by of an aneurysm either of the abdominal (11 cases) or of the common iliac artery (3). It should be mentioned that in none of the 16 the correct diagnosis of this rare condition was made prior to surgery or autopsy.

The attack begins quite suddenly with excruciating pains in the lower abdomen and signs of shock, followed by syncope. The pains irradiate into lumbar and gluteal regions and along the thighs. In rare cases only was it possible to palpate the mass as a diffuse mass, more often on the left on the right side. Even rarer were the cases in which it was possible to palpate the aneurysm itself as a pulsating mass with well defined borders close to the hematoma.

In 3 cases only an x ray examination was made revealed an opacity with indistinct borders in the left flank which blurred the shadow of the kidney and the psoas muscle. Three cases simulated the picture of acute peritonitis and the patients underwent surgery with the diagnosis of ruptured appendix or ovulus. In 2 other cases ecchymoses into the scrotum and the root of the penis were observed several days after the attack, the hematoma having spread through the inguinal canal to the genital region. In most cases the patients died within hours or a few days after the attack. In those who survived the initial attack, the picture of a paralytic ileus developed several days later and led to exploratory laparotomy in several instances.

The outcome has been fatal in all cases. Ligature of the ruptured artery or aneurysm was not tried in any instance. WERNER M. SOLMITS, M.D.

**Gastric Syphilis in Pseudoneoplastic Form** (*La syphilis gastrique a forme pseudoneoplasique*)  
PAUL CHENE, ALICE PILLET-SAVATON and ANDRÉ SIMON *Presse med* 1947 No 74 874.

Roentgenologically a 56 year old woman exhibited shadow defects of the greater curvature of the antrum suggesting neoplasm while anorexia, vomiting and regurgitation had led to extreme emaciation, abdominal ascites, and pronounced enlargement of the liver and spleen. Later megacosophagus was noted. The patient refused treatment by surgery and later developed jaundice and finally a gumma of the frontal region. Under vigorous antisyphilitic treatment the roentgenologic findings in the stomach and cardia and the ascites disappeared, however some enlargement of the spleen and macronodular liver persisted.

The authors ascribe the antral phenomena to a syphilitic perihepatitis and the cardiac symptoms to a syphilitic perisplenitis; that is they believe that the entire process was the result of a syphilitic perivisceritis and think that such a process may be in effect in many other disease pictures.

This condition is compared with the so-called *mal de Engasgo* of the Brazilian doctors who describe this endemic esophageal dilatation in the regions of Brazil which are infested with malaria (paludal perisplenitis). JOHN W. BRENNAN, M.D.

# GYNECOLOGY

## UTERUS

Contribution to the Morphological Study of the Ovary and of the Endometrium in Myofibromas of the Uterus (Contributo allo studio morfologico dell'ovario dell'endometrio nei miofibromi uterini) EUGENIO MORACCI. *Arch. ital. gine.* 1947 53 193

After stating the different views regarding the clinical coexistence of myofibroma, polycystic ovary and glandular hyperplasia of the endometrium, the author found such a divergence of ideas that he was prompted to study the material of 30 cases of myofibromas subjected to subtotal hysterectomy and bilateral adnexectomy to ascertain in each case the morphologic characteristics of the ovary and endometrium in order to deduct functional characteristics and the possible clinical manifestations.

The findings of the morphologic study of the ovary and endometrium in the 30 cases of uterine myofibromas were as follows:

1. A polycystic ovary was found in 17 cases, but in only 3 cases was there a concomitant glandular cystic hyperplasia of the endometrium (considered to be certain anatomical evidence of hyperestrinism). Eleven cases presented simple glandular hyperplasia, and 4 normal uterine mucosae in different functional stages.

2. In 3 cases, a sclerotic ovary with diffuse follicular atresia was found and the uterine mucosa presented an atrophic aspect.

3. In 11 cases active corpora lutea were found in the ovaries. The remaining cases had only corpora albicantia.

4. In the cases of simple glandular hyperplasia the endometrium revealed concomitant zones of thrombosis and necrosis of the vascular walls.

5. In 18 cases the author ascertained the presence of menorrhagia, metrorrhagia and a condition bordering on metrorrhagia. The bemic losses seemed to be associated with hyperplastic as well as atrophic changes of the uterine mucosa.

6. Although it can be admitted that uterine fibromyomas are usually accompanied by a dysfunction of the ovary there are no favorable data to indicate that the genesis of the tumor is always related to hyperproduction of estrogenic hormone.

JOSEPH M. A. PAPE, M.D.

The Use of Multiple Sources of Radium Within the Uterus in the Treatment of Endometrial Cancer A. N. ARNOLD, WILLIAM W. STAMBERG, and JAMES F. NOLAN. *Am. J. Obst.* 1948, 55 64.

A total of 93 patients were treated for corpus cancer at the Barnes Hospital and the Barnard Free Skin and Cancer Hospital, St. Louis, Missouri from 1936 to 1941 inclusive. The method of radium treatment was changed from one employing intrauterine tandems to a technique using multiple cap-

sules of radium packed individually into the uterine cavity in the attempt to fill all the available space. The use of radium was preceded by the external application of x-rays. The period of years included in the report antedates the onset of the planned method of treatment established in 1938.

The attempt is made to compare the relative effectiveness of treatment with intrauterine tandem of radium, and by the use of multiple capsules. For that comparison the effect of certain biologic properties of tumor growth are also considered in their relation to the end results.

Variation in survival rate is found with histologic type, for treatment by radiation alone as well as in conjunction with hysterectomy. Better results were obtained in the more highly differentiated forms. An improvement in clinical results was obtained with the use of multiple capsules.

Variation in survival rate is found also with size of the uterus. For treatment by radiation alone the results in uteri of small size were about equal for tandems and multiple capsules. In these cases a linear arrangement of radium tubes may fill the uterine cavity with reasonable completeness. Among 4 patients with large uteri, however, there were no 5 year survivors following treatment with x-rays and radium tandem alone. The use of intrauterine tandems in conjunction with surgery resulted in survival of about half of the patients. Only 3 showed enlargement of the uterus. The results from the use of multiple capsules and hysterectomy appear essentially independent of uterine size. About three-fourths of each group survived the 5 year period.

Despite the fact that the survival rates were affected by both histologic type and uterine size, improvement in the clinical results could be shown by the use of multiple capsules when comparison was made on the basis of radium treatment only. Among patients treated by radiation alone the use of intrauterine tandem resulted in survival of only 23 per cent, but 38 per cent of those irradiated with multiple capsules were alive and well at the end of the 5 year period. For treatment by irradiation and hysterectomy the use of intrauterine tandems resulted in survival of 34 per cent, but survival following the use of multiple capsules of radium was 79 per cent.

More reliable than histologic type or uterine size in establishing the clinical result to be expected was the persistence or disappearance of tumor within the uterus after preoperative irradiation. Among 32 patients treated by hysterectomy after the use of x-rays and radium, a persistent tumor was identified in 47 per cent of which group only 46 per cent survived for a 5 year period. Among the patients in whom no tumor was identified the survival rate was 83 per cent. Persistent tumor was found in 77 per cent of the patients irradiated by tandems. Only 26 per cent of those in whom multiple capsules were

employed showed viable cancer in the specimen removed at hysterectomy.

A discussion is given upon the improvement in distribution of radiation and in tissue dose for sources of radium within the uterus. By means of this method it has been practical to increase the total amounts of radiation employed in the treatment of cancer of the uterus. The incidence of accidental sequelae in 2 patients are described and the interval between preoperative irradiation and hysterectomy is discussed. JOHN R. WOLFF M D

**Treatment of Cervical Cancer** LUDWIG ADLER.  
*Acta radiol. Stockh.* 1947 28 474

The author presents a survey of the history of gynecology and radiotherapy in the treatment of cancer of the cervix, and describes his elective treatment of the disease (extended vaginal operation with immediate postoperative insertion of radium in most cases) which he has used for more than 20 years. The results of the treatment are described. The permanent cures following the elective treatment amounted to 39.4 per cent. Within the last 15 years the primary mortality was 3.9 per cent. Attention is called to the morbidity accompanying irradiation.

DANIEL G. MORTON M D

**Summary of Results in the Radiation Treatment of Uterine Cervical Cancer** HAROLD SWANBERG.  
*Acta radiol. Stockh.* 1947 28 554.

The author presents a statistical study of 1796 patients who suffered all stages of cancer of the uterine cervix and who were treated exclusively by radiation therapy in 18 well known radiotherapeutic centers in 8 countries. Treatment was begun in 1933. The conclusion is reached that of all 18 radiotherapeutic centers, regardless of the number of patients treated, the best results were secured at the Radium Institute of the University of Paris where 47.2 per cent of all patients treated were alive and free from cancer at the end of the 5 year period.

The radiation technique which was used in Paris to secure these results consisted of combined internal (intracavitary) and external (transpelvic) irradiation (internal radium alone in stage 1) the internal radium treatment consisted of multiple small milligram centers of heavily filtered radium distributed through out the entire length of the uterine canal and the width of the vaginal vault. The radium was administered slowly over a period of 5 days time and patients received an average of 8,000 milligram hours of treatment.

DANIEL G. MORTON M D

**ADNEXAL AND PERIUTERINE CONDITIONS**

**Clinical and Pathologic Survey of Ovarian Tumors Treated at Radiumhemmet; Dysgerminomas.** LARS SANTESSON *Acta radiol. Stockh.* 1947 28 644.

The author presents the first part of a clinical and pathological survey of about 700 cases of ovarian

tumors treated at Radiumhemmet through 1940. Among these there were 26 cases of dysgerminoma which the author reviews together with 11 cases of dysgerminoma in patients who were treated in later years. In addition 192 cases from the literature are reviewed. Only those cases are included which in all respects show histological structures typical of this rather rare type of ovarian tumor. The incidence of pure dysgerminomas in the whole material of ovarian tumors at Radiumhemmet is 3.7 per cent. Five year results are available for 27 of the 37 cases of dysgerminoma at the Radiumhemmet.

It should be remembered that Radiumhemmet is a clinic which is operated principally for the radiological treatment of tumors. For this reason only those patients who might benefit by such treatment are admitted. The material collected there must thus be of a specially selected type and not representative of material found in clinics designed for treatment of general surgical conditions.

The local symptomatology of dysgerminomas is generally not distinctive and corresponds largely to that of other solid ovarian tumors. The duration of symptoms in this series as in the cases described earlier was short which suggested a rapid tumor growth.

Meyer in 1925 laid stress upon the frequent occurrence of dysgerminoma with pseudohermaphroditism, hypogenitalism and other forms of sexual maldevelopment. In this material however only 3 cases showed such maldevelopment and in 129 cases (of 187) collected from the literature the tumor occurred in an otherwise normal person.

The dysgerminoma predominantly affects young individuals under 30 years of age. In 28 of the cases in this series the tumor occurred in patients under 30 years of age.

The malignancy of the dysgerminomas appears partly through local infiltration of the surrounding tissues and partly by giving rise to metastases. The infiltration occurs especially along the intraligamentary lymphways. The capsule is only rarely broken through but large tumors may rupture and in this way produce peritoneal implantation metastases. Rupture may occur either spontaneously or at operation, and is of serious consequence. Rupture occurred before operation in 6 of the patients who had been treated more than 2 1/2 years previously. Five of them have died although in 2 the operation was considered radical. Peritoneal implantation metastases were found at operation in the other 3 patients.

Usually, these tumors metastasize along the lymphatics first to the retroperitoneal lymph nodes along the large abdominal vessels, later to the mediastinal lymph nodes. From there they may disseminate through the thoracic duct to the supraclavicular region. Hematogenous dissemination may occur but is rare. Occasionally a positive Aschheim-Zondek reaction is present.

If these cases are counted together with the cases in the literature in which the location is mentioned

# GYNECOLOGY

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sules of radium packed individually into the uterine cavity in the attempt to fill all the available space. The use of radium was preceded by the external application of x-rays. The period of years included in the report antedates the onset of the planned method of treatment established in 1938.

The attempt is made to compare the relative effectiveness of treatment with intrauterine tandem of radium, and by the use of multiple capsules. For that comparison the effect of certain biologic properties of tumor growth are also considered in their relation to the end results.

Variation in survival rate is found with histologic type for treatment by radiation alone as well as in conjunction with hysterectomy. Better results were obtained in the more highly differentiated forms. An improvement in clinical results was obtained with the use of multiple capsules.

Variation in survival rate is found also with size of the uterus. For treatment by radiation alone the results in uteri of small size were about equal for tandems and multiple capsules. In these cases a linear arrangement of 1 radium tube may fill the uterine cavity with reasonable completeness. Among 4 patients with large uteri however there were no 5 year survivors following treatment with x-rays and radium tandem alone. The use of intrauterine tandems in conjunction with surgery resulted in survival of about half of the patients. Only 1 showed enlargement of the uterus. The results from the use of multiple capsules and hysterectomy appear essentially independent of uterine size. About three-fourths of each group survived the 5 year period.

Despite the fact that the survival rates were affected by both histologic type and uterine size improvement in the clinical results could be shown by the use of multiple capsules when comparison was made on the basis of radium treatment only. Among patients treated by radiation alone the use of intrauterine tandems resulted in survival of only 22 per cent but 32 per cent of those irradiated with multiple capsules were alive and well at the end of the 5 year period. For treatment by irradiation and hysterectomy the use of intrauterine tandems resulted in survival of 54 per cent, but survival following the use of multiple capsules of radium was 79 per cent.

More reliable than histologic type or uterine size in establishing the clinical result to be expected was the persistence or disappearance of tumor within the uterus after preoperative irradiation. Among 3 patients treated by hysterectomy after the use of x-rays and radium, a persistent tumor was identified in 47 per cent of which group only 46 per cent survived for a 5 year period. Among the patients in whom no tumor was identified the survival rate was 83 per cent. Persistent tumor was found in 77 per cent of the patients irradiated by tandems. Only 26 per cent of those in whom multiple capsules were

employed showed viable cancer in the specimen removed at hysterectomy.

A discussion is given upon the improvement in distribution of radiation and in tissue dose for multiple sources of radium within the uterus. By means of this method it has been practical to increase the total amounts of radiation employed. Accidental sequelae in 2 patients are described and the interval between preoperative irradiation and hysterectomy is discussed. JOHN R. WOLFF M.D.

**The Treatment of Cervical Cancer** LUDWIG ADLER.  
*Acta radiol. Stockh. 1947 18 474.*

The author presents a survey of the history of surgery and radiotherapy in the treatment of cancer of the cervix, and describes his elective treatment of the disease (extended vaginal operation with immediate postoperative insertion of radium in most cases) which he has used for more than 20 years. Laparotomy with radium insertion is performed in patients unfit for vaginal operation, inoperable cancers and bad surgical risks are irradiated only.

The permanent cures following the elective treatment amounted to 39.4 per cent. Within the last 15 years the primary mortality was 3.9 per cent. Attention is called to the morbidity accompanying irradiation.

DANIEL G. MORTON M.D.

**Summary of Results in the Radiation Treatment of Uterine Cervical Cancer** HAROLD SWAMBERG.  
*Acta radiol. Stockh. 1947 18 554.*

The author presents a statistical study of 1,796 patients who suffered all stages of cancer of the uterine cervix and who were treated exclusively by radiation therapy in 18 well known radiotherapeutic centers in 8 countries. Treatment was begun in 1933; analysis of the end results was made 5 years later.

The conclusion is reached that of all 18 radiotherapeutic centers, regardless of the number of patients treated, the best results were secured at the Radium Institute of the University of Paris where 47.2 per cent of all patients treated were alive and free from cancer at the end of the 5 year period.

The radiation technique which was used in Paris to secure these results consisted of combined internal (intracavitary) and external (transpelvic) irradiation (internal radium alone in stage 1); the internal radium treatment consisted of multiple small milligram centers of heavily filtered radium distributed throughout the entire length of the uterine canal and the width of the vaginal vault. The radium was administered slowly over a period of 5 days; time and patients received an average of 8,000 milligram hours of treatment.

DANIEL G. MORTON M.D.

**ADNEXAL AND PERIUTERINE CONDITIONS**

**Clinical and Pathologic Survey of Ovarian Tumors Treated at Radiumhemmet; Dysgerminomas.** LARS SANTESSON *Acta radiol., Stockh. 1947 18 644.*

The author presents the first part of a clinical and pathological survey of about 700 cases of ovarian

tumors treated at Radiumhemmet through 1940. Among these there were 26 cases of dysgerminoma which the author reviews together with 11 cases of dysgerminoma in patients who were treated in later years. In addition 192 cases from the literature are reviewed. Only those cases are included which in all respects show histological structures typical of this rather rare type of ovarian tumor. The incidence of pure dysgerminomas in the whole material of ovarian tumors at Radiumhemmet is 3.7 per cent. Five year results are available for 27 of the 37 cases of dysgerminoma at the Radiumhemmet.

It should be remembered that Radiumhemmet is a clinic which is operated principally for the radiological treatment of tumors. For this reason only those patients who might benefit by such treatment are admitted. The material collected there must thus be of a specially selected type and not representative of material found in clinics designed for treatment of general surgical conditions.

The local symptomatology of dysgerminomas is generally not distinctive and corresponds largely to that of other solid ovarian tumors. The duration of symptoms in this series, as in the cases described earlier, was short which suggested a rapid tumor growth.

Meyer in 1925 laid stress upon the frequent occurrence of dysgerminoma with pseudohermaphroditism, hypogonadism and other forms of sexual maldevelopment. In this material however only 2 cases showed such maldevelopment and in 129 cases (of 187) collected from the literature the tumor occurred in an otherwise normal person.

The dysgerminoma predominantly affects young individuals under 30 years of age. In 28 of the cases in this series the tumor occurred in patients under 30 years of age.

The malignancy of the dysgerminomas appears partly through local infiltration of the surrounding tissues and partly by giving rise to metastases. The infiltration occurs especially along the intraligamentary lymphways. The capsule is only rarely broken through but large tumors may rupture and in this way produce peritoneal implantation metastases. Rupture may occur either spontaneously or at operation and is of serious consequence. Rupture occurred before operation in 6 of the patients who had been treated more than 1 1/4 years previously. Five of them have died although in 2 the operation was considered radical. Peritoneal implantation metastases were found at operation in the other 3 patients.

Usually these tumors metastasize along the lymphatics first to the retroperitoneal lymph nodes along the large abdominal vessels later to the mediastinal lymph nodes. From there they may disseminate through the thoracic duct to the supraclavicular region. Hematogenic dissemination may occur but is rare. Occasionally a positive Aschheim-Zondek reaction is present.

If these cases are counted together with the cases in the literature in which the location is mentioned

the tumors were located in the right ovary in 51 per cent of the patients. In the left ovary in 30 per cent and bilaterally in 17 per cent.

Macroscopically these tumors are rounded, with smooth or coarsely lobulated surfaces, and are enclosed in fibrous capsules that remain intact in the early stages, but sometimes rupture in advanced stages. The consistency varies from hard and rubbery in the smaller tumors to spongy and friable in the larger ones. On cut surface, the tumor appears to be of a greyish-pink color often with areas of a distinctly yellowish hue. The tumor mass is rather homogeneous. Strands of fibrous tissue may however, divide it into lobules.

There are few tumors of the ovary which present such distinctive characteristics as does the dysgerminoma. This applies to both the cell type and the general architecture.

The dysgerminoma cells are markedly uniform rather large, round, or polyhedral and have a moderate amount of granular or clear, often translucent cytoplasm containing relatively large amounts of glycogen. The nuclei are large, vesicular with thick nuclear membranes. They are rich in chromatin and have usually more than one well developed highly basophilic nucleolus. Mitotic figures are present in varying, often large, numbers. The structure of the cells is suggestive of cells in rapid proliferation. The arrangement of the tumor cells is rather characteristic, although it varies even in different parts of the same tumor. The cells are arranged either in single-layered columns or in strands, in small acini-like groups or in larger irregular nests of cells, separated by a more or less abundant and usually delicate network of connective tissue stroma. A most prominent feature is that the stroma is abundantly infiltrated with lymphocytes which sometimes even form actual lymph follicles with a distinct germinal center.

Regressive changes are frequent and often so extensive as to constitute another specific feature of the tumor. They consist in a progressive acidophilic necrobiosis with fatty degeneration or intracellular calcification and finally necrosis.

The histological structure of dysgerminoma is undoubtedly that of a malignant tumor. The authors have not been able to correlate the degree of malignancy with any particular microscopic feature.

There seems to be general agreement that the prognosis must be considered as serious, although not as bad as in cases of histologically clearly malignant ovarian carcinomas. The number of cases in the literature which have been followed over 5 years is, however still rather small. Thus, of the 98 cases studied by Seegar in 1938 there are only 40 cases in which the 5 year results can be studied, and among 192 cases assembled from the literature by the author there are only 80 such cases.

As has already been pointed out, it has not been found possible to judge the prognosis from the histological structure of the tumor. It seems, on the other hand that rather reliable prognostic judgment can

be based on the extension of the tumor process observed at operation. Of 61 patients in whom the tumors were still confined to the ovary and with intact capsule (39 from the literature and 22 from this material) 49 patients are living over 5 years and the rest have died as a result of the tumor while of 28 patients (21 from the literature and 7 from this material) in whom there was evidence of a break in the capsule 24 have died from the tumor and only 4 are living over 5 years.

The survival rate in all of the 5 year cases is 51 per cent (55 of 107 cases). Of the patients treated at Radiumhemmet more than 5 years ago this rate is 66.7 per cent (18 of 27 cases).

There seems to be a general agreement that radical surgical removal of the tumor, followed by radiotherapy is the treatment of choice for dysgerminomas. There are, however different opinions as regards the necessary extensiveness of the operation as well as of the radiological treatment. A detailed attempt is made to judge the value of radical versus conservative surgery and of deep x-ray therapy. The number of cases is still too small to allow any definite judgment of the risks as compared with the gains entailed in the conservative mode of surgical procedure, which is warranted only if it is followed by radical radiological treatment, i.e. prophylactic radiation directed at the unaffected ovary. The author further states that "radical prophylactic radiological treatment given in the right manner does not impair the functions of the unaffected ovary left at the operation. Thus, in such cases the menstruations mostly return and even pregnancies with the birth of normal children may occur."

Five fields of roentgen treatment have been used—one abdominal field, one on the back against the pelvic region on each side, and one central field against the upper part of the back up to the diaphragm. This last field is of special importance in the prophylactic roentgen treatment because of the fact that these tumors at first mostly metastasize to the retroperitoneal lymph nodes along the large abdominal vessels. The doses have varied from 400 to 600 roentgen units given in separate treatments of from 100 to 300 roentgen units with 0.5 mm. of copper as filter. On the field over the upper part of the back the doses have been somewhat smaller.

Among the cases assembled from the literature, there are only 3 cases of patients operated upon and radiologically treated for whom 5 year results are given. Twelve of these have lived over 5 years, a survival rate of 57.1 per cent. If these cases are counted together with the cases in this material, the survival rate is 62.5 per cent (30 of 48 patients). There are, on the other hand 48 cases in the literature with 5 year follow-up data. These patients according to the given clinical histories, have only been operated upon and have not been radiologically treated. Of these 48 patients, 20 (41.7%) have lived over 5 years. These figures indicate how important the radiological treatment is in obtaining the best results in patients with dysgerminomas.

*Editorial comment:* There are few radiologists in this country who would regard the doses given as can-  
cericidal; furthermore the persistence of normal ac-  
tion in the remaining ovary in spite of radio-  
logical treatment would seem to indicate that  
counts given were insignificant.

DANIEL G. MORTON, M.D.

### MISCELLANEOUS

**Multiple Blastomatosis and Preblastomatosis of the Genital Tract with Particular Attention to the Endocrine Oncogenetic Factors** (In tema di blastomatosi multiple e di preblastomatosi della sfera genitale con particolare riguardo ai fattori oncogenetici endocrini) GIUSEPPE NIOSI COSIMANO  
*Ginecologia, Tor. 1947 13 453.*

A woman 57 years of age, who had had 3 normal pregnancies and had entered the menopause without disturbances 5 years previously, reported moderate loss of blood from the genitalia for the past 4 months. Gynecologic examination disclosed only that the uterus was slightly larger than normal. Curettage was performed and the histologic diagnosis was hypertrophy and glandular hyperplasia of the endometrium. She was given 6 castration doses of roentgen rays. About 5 months later she was re-admitted to the hospital with a history of another blood loss of 15 days' duration, followed by rapid and progressive enlargement of the abdomen which contained a round tumefaction the size of a 7 months' pregnancy. At operation a large tumor of the left ovary was removed. The histologic diagnosis was proliferating adenocystoma with signs of malignancy. After 5½ months she was again admitted because of irregular blood losses for a period of 2 months; she was treated by curettage. The histologic diagnosis was adenocarcinoma of the endometrium. The uterus and the right ovary were then removed.

There is no doubt that the ovarian tumor was present before the metrorrhagias occurred; that the latter were due to the former; that the uterine carcinoma was not yet present at the time of the first metrorrhagias and was not a metastasis from the ovarian tumor. The two tumors must be regarded as independent and possibly the expression of a special state of predisposition (oncogenous diathesis) of woman to tumors in general and to those of the genital tract in particular.

To interpret the succession of morbid elements in the present case it is necessary to consider the question of the genesis of the blastomas. Many authors

have already stated that there must be a connection between internal secretions and the genesis of the tumors, and the literature on the subject has assigned an important rôle in this to folliculin in particular, but the mechanism by which folliculin causes this cellular disturbance is still unknown. It is practically certain that there is a preblastomatous stage which may extend itself into the true blastomatous stage, i.e., the same stimuli which are capable of inducing in a normal tissue such structural and functional changes as to make it resemble a neoplastic tissue are also apt to cause the formation of real neoplasms. There is no doubt that the morbid forms known as cystic glandular hyperplasias of the endometrium belong to the preblastomatous stage and it is logical to suppose that uterine or internal adenomyosis may also be part of this stage. Therefore the simultaneous and successive presence of precancerous and cancerous stages is illustrated in this patient (ovarian tumor in its initial stage and hyperplasia of the endometrium).

Could not the two lesions be the result of the same factor which acting simultaneously on different organs encounters a different reaction and resistance in the ovary and in the uterus so that the response is the formation of a tumor in the first but is limited to the pre-tumoral stage in the second? The persistence of the stimulus acting on the endometrium could then lead to ulterior evolution of the mucosa so that the preblastomatous proliferation passes into the true blastomatous stage. In fact the second curettage revealed adenocarcinoma of the uterus.

In menopausal women there is a discharge in the circulation of prolactin A, which may reach considerable quantities. The relations between this hormone and folliculin are well known. An eventual impulse to the production of folliculin may become more or less continuous and be of more or less marked degree; therefore rather large quantities of folliculin may be poured into the circulation either continuously or more probably intermittently. The author thinks that such an eventuality occurred in his patient who presented a succession of pre-tumoral and tumoral manifestations. It is possible that if the first intervention had been more radical and had included also removal of the apparently normal opposite ovary the adenocarcinoma of the uterus would not have appeared. This fact should be kept in mind to serve as a guide in the operative conduct of the gynecologist in similar cases as it would eliminate another source of folliculin.

RICHARD KEMEL, M.D.



# OBSTETRICS

## PREGNANCY AND ITS COMPLICATIONS

**A New Biologic Reaction for the Diagnosis of Pregnancy** G. M. Mainini's Reaction (Una nueva reacción biológica para el diagnóstico precoz de la gestación. La reacción de Galli Mainini) ALVARO POLO SANTIAGO. *Arch. Surg. med.* 1947 30: 437

The author discusses the various classic tests for pregnancy. An appraisal of each is given. Besides being time-consuming each has some drawback in procedure which makes the test impractical for immediate diagnosis. He describes the Galli Mainini test and recommends it because it is accurate (from 97 to 98%) its time element is negligible ( $\frac{1}{2}$  to 4 hours) it is cheap (the common male toad found everywhere in Uruguay is used), and it is simple (it can be done by any technician in any laboratory).

The test consists in the injection of 10 c.c. of urine of the woman suspected of being pregnant into the lateral lymphatic sac of the toad (*Bufo-arenarum* Henae). One half-hour later the toad's urine is collected from the cloaca by means of a special glass catheter and is examined microscopically. If there is a pregnancy spermatozoa appear in large quantities as so many small commas moving rapidly through the fluid.

STEPHEN A. ZIEGLER, M.D.

**Blood Volume in Pregnancy** CHARLES E. McLENNAN and L. G. THOMAS. *Am. J. Obst.* 94: 55, 56.

Despite the fairly general acceptance of the theory that there is a real increase in volume of plasma and red cells during pregnancy, there is no agreement as to the precise magnitude of this increase at the various stages of gestation or the rapidity with which the volumes return to normal in the postpartum period.

The authors present a chromatographic technique for the extraction of Evans blue from plasma to determine the plasma volume and from this value the total blood volume is calculated by use of the hematocrit. Determinations were made on 30 normally pregnant women at term and on the same women 7 days after delivery. A control group of 10 normal nonpregnant women was used to check the results with this technique against previously determined standards for normal females.

At term the average value for plasma volume was about 40 per cent greater than plasma volume in the control series and the total blood volume was 33 per cent greater. While the red cell volume appeared to rise about 30 per cent, the significance of this change was not so striking as in the case of the plasma volume and the total blood volume. Within a week after delivery the blood volume had returned virtually to nonpregnant levels.

Individual variation in the blood volume during pregnancy is enormous. Standard deviations are

relatively much greater for pregnant subjects than for either the controls or postpartum patients.

A few observations indicate that the dye-dilution method is not invalidated by transfer of the dye across the placental barrier but the question as to whether dye is trapped at the placental site is still unsettled.

Data from several previous publications has been subjected to statistical analysis and certain unwarranted conclusions previously made have been critically reviewed.

The authors of previous articles on blood volume in pregnancy have speculated freely on the cause or causes of the apparent increase in volume. The recent finding of Furth and Sobel that granulosa cell tumors in mice were associated with hypervolemia revives the suggestion that increased estrogen levels are in some way concerned with elevation of the blood volume.

The authors conclude that it seems unlikely that anything yet published, including this report, has given a thoroughly reliable picture of what happens to the blood volume in pregnancy. A great many more determinations should be made and the validity of dye techniques must be ascertained by the newer radioactive iron procedures for red cell volume.

JOHN R. WOOLF, M.D.

**Thrombophlebitis in Pregnancy** G. D. MATTHEW. *Edinburgh M. J.* 94: 54, 64L.

The overall incidence of thrombophlebitis and pulmonary embolism is in the region of 1 per cent at the Simpson Maternity Pavilion. The incidence rises in caesarean section to about 4 per cent. During the past 20 years there have been 17 reported deaths from pulmonary embolism. The location of veins involved in thrombophlebitis is essentially the same in obstetric and nonobstetric patients with the exception of the deep pelvic veins. In the 17 fatal cases mentioned only 7 showed clinical evidence of thrombosis affecting the veins of the pelvis or lower limbs.

Fifty consecutive cases of thrombophlebitis without specific therapy are compared with 19 cases treated with heparin. Unfortunately an adequate supply of heparin was not always available and in some cases the supply was insufficient to complete the course of treatment. Of the 19 patients treated 16 suffered from thrombophlebitis of the pelvis and/or lower limbs being regarded as deep and 3 superficial in the remainder. 1 patient had thrombophlebitis in the arm following intravenous therapy and 2 patients had pulmonary embolism. There was a higher incidence of abdominal section in the heparin treated cases (41%) as compared with the control series (26%).

All of the patients responded rapidly to heparin therapy with 3 exceptions. Embolism occurred in both of these—in one after premature interruption of

atment and in the other a full course of treatment was rendered impossible because of insufficient supplies. One of the main hopes in heparin therapy is marked reduction in the period of hospitalization. The average difference in hospitalization between the heparin-treated and the control was 1 week. GEORGE BLINCK M.D.

#### **Hemorrhage in Pregnancy** J. KENWORTHY OGDEN *Brit M J.*, 1948 1 389.

A case of eclampsia complicated by an accidental retroperitoneal hemorrhage. Conservative management of the hemorrhage had to be abandoned in favor of classical cesarean section because of the fact that the uterus remained obstinately tense, and sudden increase in retroperitoneal hemorrhage made immediate operative intervention imperative. The patient made a smooth recovery until the fourth postoperative day when she died suddenly of severe retroperitoneal hemorrhage.

At autopsy a massive retroperitoneal hemorrhage was found which seemed to originate in the region of the junction of the body and neck of the pancreas. The hemorrhage burst through the peritoneum of the lesser sac and from 4 to 5 pints of blood passed through the aditus of the lesser sac into the general peritoneal cavity.

Six previously reported cases of retroperitoneal hemorrhage occurring during pregnancy are reviewed. In 3 cases, a condition of toxemia of pregnancy was present. One of the outstanding features of the pathology of eclampsia is capillary thrombosis followed by extravasation of red blood cells, and the author wonders as to whether or not a similar condition might happen in vessels of larger caliber in isolated instances. GEORGE BLINCK M.D.

### **LABOR AND ITS COMPLICATIONS**

**Premedication and Anesthesia in Obstetrics: Practical Aspects.** BRIT B. HERSHKOW *Amer Anesthesiology* 1948 9 73.

The author states that the purpose of his paper is two-fold: (1) to consider some of the essential principles that are basic to any plan of premedication and anesthesia in obstetrics and (2) to present the practical aspects of the problem as experienced at the Boston Lying in Hospital. He discusses the aims of an ideal premedication from the standpoint of the mother, the obstetrician and the anesthesiologist, but believes that the ideal agents or techniques to accomplish the objectives he outlines are not yet available. He emphasizes the over-all capabilities of the obstetrical team as being the real determinants of the degree of safe relief for mother and child.

The use of scopolamine with combinations of various drugs is discussed, and the advantages and disadvantages are thoroughly covered. It is believed that scopolamine is the best amnesic available and the author has noted no demonstrable ill effects on the fetal or neonatal vital functions. It may be given subcutaneously intramuscularly or

intravenously with shortened periods of maximum effect from the time of administration. It is noted that scopolamine will occasionally produce edema of the eyelids, lips, or uvula, and that its cortical effect, the production of excitement is present in about 40 per cent of obstetrical cases.

Four different periods in which different amnesics were used are summarized. In the present period scopolamine is utilized as a preliminary sedative early in labor to relieve apprehension and when labor is well established a combination of scopolamine and apomorphine is used. Apomorphine is administered to allay the exciting effects of the scopolamine. The initial dose is 1/100 grain of each followed by repeat doses of 1/150 gr scopolamine and 1/50 gr apomorphine. Three cases are presented in detail. All 3 patients had normally progressing labors which terminated successfully and in which the mother had no memory after the initial injection.

The use of barbiturates is summarized on the basis of previous reports from the Boston Lying in Hospital. Their advantages and disadvantages are outlined in detail and the analysis is favorable to them. However one of the disadvantages—respiratory complications—is worthy of mention. The most serious complication is pulmonary edema with a clinical picture of stertorous respiration, dyspnea, laryngeal spasm, bronchospasm, increased bronchial secretions with bubbling rales throughout the lung fields, diminution of minute-volume, respiratory ventilation, cyanosis, tachycardia, and a fall in the blood pressure. Nembutal was found to produce this complication twice as often as any of the other barbiturates used. GEORGE B. DRABURN M.D.

**Continuous Caudal Analgesia.** ROBERT A. HINGSON, WALDO B. EDWARDS, CLIFFORD B. LULL, FRANK E. WHITACRE and H. CHARLES FRANKLIN *J Am M Ass* 1948 136 221.

At the time of the present analysis 600,000 cases had been reported in which labor and delivery were managed under continuous caudal analgesia. All of the reports have emphasized the well being of the newborn infant. In spite of this certain disadvantages to the fetus are apparent. Hypotension as a result of the nerve block of vasomotor nerves may result in intrauterine anoxia. Too early administration or an anesthetic level that is high enough to interfere with uterine motility may cause arrest or prolongation of the labor with increased trauma. The incidence of operative delivery is increasing because of the absence of expulsive powers. Fetal hypersensitivity to the drug that is used may occur.

The authors report a total of 7,893 births—5,059 under caudal anesthesia and 2,834 under other forms of anesthesia. The analysis clearly reveals that less respiratory difficulty was experienced with the use of continuous caudal anesthesia than with any other method. The same conclusion was reached with regard to the number of stillbirths and neonatal deaths. An analysis of differences in weight gain failed to reveal any significant data.

The authors point out (Memphis group) that the stillbirth rate for deliveries without the aid of anesthesia was 80.4 per thousand live births, the neonatal mortality being 63.6 per thousand live births in the same group. This was compared to the 18.4 rate for both stillbirth and neonatal deaths in cases in which caudal anesthesia was used. With spinal anesthesia, the stillbirth rate was found to be 45.2 per thousand live births and the neonatal death rate 29.0 per thousand live births.

The authors failed to draw any conclusions from their analysis.

JAMES F. DONOVAN, M.D.

**Pelvic Delivery following Cesarean Section** DANIEL H. HINDMAN *Am J Obs* 948, 55 273

During the interval from January 1, 1928 to January 1, 1947, there have been effected at the Boston Lying-in Hospital 177 deliveries through the natural birth passage in 118 patients who had previously been subjected to cesarean section. Thirty of these women were delivered twice subsequent to hysterotomy 7 three times, and 3 four times and 1 was delivered five times and another six times respectively. There was one maternal mortality in the series, ascribed to aspiration pneumonia. The great proportion of these patients had been subjected to cesarean section for a temporary indication.

The fundamental question revolves about the behavior of the uterine scar in subsequent pregnancies

whether it shall prove adequately firm to tolerate distention of the uterus as pregnancy advances and to withstand the stress of labor itself. The functional strength of the scar is intimately dependent upon the histology of wound healing in the uterus and the location of the incision. The literature is reviewed in regard to the anatomic study of these scars. The author presents in some detail the 8 cases of disruption of a cesarean scar in a subsequent pregnancy. Two such accidents occurred in patients who were selected for prospective delivery through the pelvis. Only 1 of these patients experienced labor.

Precautions to be followed in the selection of cases, instructions to the patients, and instructions on the management of labor and delivery are presented. The technique of manual exploration of the uterine cavity following delivery is given in detail.

From an analysis of the cases presented and a review of the literature, the author concludes that in properly selected patients who have been previously subjected to cesarean section for some temporary indication, attempts at pelvic delivery are to be encouraged, provided certain precautions are observed. By pursuit of such a policy, one may anticipate not only a considerable curtailment in the frequency of cesarean section but a gratifying reduction in maternal mortality and morbidity as well as some conservation of hospital days.

JOHN R. WOLFE, M.D.

# GENITOURINARY SURGERY

## ADRENAL, KIDNEY AND URETER

**Treatment of Renal Insufficiency** GEORGE W. THORN *J Urol* Balt., 1948 59 119.

Three major problems in therapy of renal insufficiency are discussed (1) nephrotic edema (2) remediable types of chronic uremia, and (3) lower nephron nephrosis. Generalized edema is most often the most incapacitating factor and this is occasioned principally by increased retention of sodium and chloride, disturbances of protein metabolism characterized by proteinuria and hypoalbuminemia and cardiac failure secondary to renal dysfunction. None of the therapeutic agents available have any effect on the underlying renal pathology but they will tend to assist in controlling the edema. This subject is admirably discussed. The preferred therapeutic agents are restricted sodium chloride, the administration of urea in patients without azotemia, and concentrated human serum albumin intravenously specifically the latter.

Under the heading of 'remediable types of chronic uremia' the author discusses various types of chronic uremia that may be modified with prolongation of life. He considers (1) obstructive uropathy (2) chronic hyperparathyroidism with renal calcinosis (3) chronic pyelonephritis without hypertension (4) "salt losing" type of chronic nephritis (5) irradiated renal intoxication and (6) subacute bacterial endocarditis. In short it is believed that any form of chronic uremia unassociated with hypertension, edema, or cardiac failure bears careful investigation since there is a strong possibility that the patient may be offered an additional period of useful life. The factors of therapeutic importance are (1) a fluid intake of 2500 to 3000 c.c. daily (2) maintenance of a normal serum chloride level (3) limitation of protein to 50 grams daily (4) transfusions as necessary or washed red cells as indicated (5) intravenous glucose and saline infusions as needed to control azotemia (6) aluminum hydroxide to reduce hyperphosphatemia and (7) serum albumin as needed for hypoproteinemia and edema. The warning of misinterpreting hypochloremia due to carbon dioxide-chloride shift is mentioned since the use of sodium chloride in this type of hypochloremia is contraindicated. The associated urinary tract infections are treated with the sulfonamides or antibiotics, which ever seems indicated by carefully executed bacteriological studies. The value of sulfonamide combinations and alkalinization in conjunction with streptomycin therapy is emphasized.

The author discusses "lower nephron nephrosis," a pathological entity common to a wide variety of damaging agents i.e. intravascular hemolytic reactions, crushing injuries, burns, nontraumatic muscular ischemia, sulfonamide intoxication and toxemia of pregnancy. The treatment of this condition is

considered under three headings (1) emergency, (2) maintenance during oliguria and anuria, and (3) reparative treatment during the early phase of diuresis. During the first phase, renal vasoconstriction and ischemia are of prime consideration. During the phase of oliguria and anuria the limitation of fluids so as to prevent flooding the body is essential, as well as the need for the administration of basic caloric requirements and the use of digitalis in the event of cardiac incompetency. In the third phase the chloride level must be watched for purposes of replacement or as occurs in damage from sulfonamides for sudden increase in chloride which is to be handled by the administration of salt-free fluid to wash out this increasing chloride level in the blood and thus obviate cerebral edema and death.

The article is exceptionally well illustrated and includes statistical data. Case reports are used to emphasize the diagnosis and therapy.

ROBERT LICH, JR. M.D.

**Traumatic Pseudohydronephrosis (Pseudohydronephrosis traumatica)** JULIO V. URIBURU and OSCAR C. CARRERO *Practica med. argent.* 1948, 35 174.

Traumatic pseudohydronephrosis is the term designating the infiltration or collection of urine and blood in the perirenal adipose tissue occasioned by rupture of the kidney. For this condition to occur it is necessary for the rent to include the pelvis or calyces of the kidney. Traumatic rupture of a ureter, an exceedingly rare condition, may also initiate pseudohydronephrosis. The latter condition, although certainly grave, does not reach the seriousness of urinary extravasation from the bladder.

Rupture of the urinary tract at the level of the bladder or of the pelvis or calyx of the kidney produces extravasation of urine and blood which first infiltrates progressively the adipose tissue and later transforms the walls into cystic sacs which contain either clear urinary fluid or dark liquid consisting of urine and clotted blood. The kidney appears to be displaced and in contact with the sac, the cavity of which generally is in communication with the urinary tree. A pure lesion of the parenchyma does not give an infiltration of urine.

The diagnosis is dependent upon the antecedent history of trauma and generally the presence of intense contusion over the lumbar region. Signs of a renal lesion, pain, and hematuria occur immediately. Most authors believe that a swelling appears early. In the chronic stage, the differentiation from a renal cyst is impossible. Flat films of the abdomen reveal a dense diffuse mass in the affected area. With the nearby organs filled with radiopaque material the stomach may be demonstrated to be elevated and elongated; the colon is pushed downward and its lumen is narrowed. The position of the swelling will influence the roentgenogram. The secreting



Fig. (Uniforu, Carreño) Radiogram of barium enema showing displacement of the descending colon and compression of the lumen by the tumor

function of the kidney on the affected side is diminished as evidenced by intravenous pyelography. Retrograde pyelography is also of diagnostic value.

A differential diagnosis must be made from rupture of a pre-existing hydronephrosis, traumatic hydronephrosis and pseudohydronephrosis. Appearance of a swelling immediately following trauma suggests a perirenal hematoma. Hematonephrosis which yields red blood cells in the urinary tract develops late and is extremely rare.

If the quantity of urine extravasated is small it may resorb. If organization occurs a chronic sclerosing perinephritis may result. However the extravasation is usually so great that resorption is impossible. Frequently infection of the contained fluid supervenes and surgical intervention becomes imperative. The function of the kidney on the affected side which may be inhibited by compression after operation is recovered. In the case reported, 15 days after operation the kidney eliminated indigo-carmin after 15 minutes, and a little after a month the indigo-carmin was eliminated at 4½ minutes.

If operation is delayed until after the development of toxic phenomena and infection the prognosis is considerably more grave. Occasionally the pathological anatomy of the lesion may necessitate nephrectomy.

Once the diagnosis of pseudohydronephrosis is established immediate operation is imperative. Two points are stressed: the cystic pouch should be emptied and the kidney should not be touched.

Rapid drainage of a large cyst will cause shock. A fistula may be left to drain to the surface and this will generally close spontaneously. Nephrectomy or partial nephrectomy is reserved for selected cases.

The case history of a young man who received severe trauma to the left lumbar region is reviewed. The swelling in the left flank appeared a month after the initial trauma. Intravenous pyelography revealed good function of the right kidney but none of the left. At operation 6 liters of uroaerous liquid were obtained. A portion of the sac was resected, sulfanilamide placed in the wound, and rubber dams were inserted. Recovery was uneventful and kidney function on the left side returned.

HAROLD W. BACCHOFF, M.D.

#### Lymphatic Cysts of the Kidney A. J. SCHOLL, J. *Am. M. Ass.* 1943, 136:4.

Peripelvic cysts of the kidney occur only rarely; they are usually small in size and in most cases they have been noted by pathologists as incidental findings at autopsy. In only a few cases have cysts of this type caused clinical symptoms. In these, the cysts were usually large and tended to distend the abdomen. In the majority of cases their peripelvic origin was recognized only on the operating table or at autopsy.

Two cases of lymphatic cysts of the kidney are reported in detail. At operation, both patients were found to have large peripelvic lymphatic cysts which were of sufficient size to cause distortion of the renal pelvis and to exert pressure on the structures of the renal hilus. These cases are of interest because of the origin and large size of the cysts, their apparent relationship to hypertension, and the similarity of the diagnostic signs to those of renal tumors.

The cysts in both cases were exceptionally large for this type of lesion and the kidney was removed in each case. The first patient was elderly and hypertensive; there was considerable destruction of the kidney and it was impossible to determine definitely whether the lesion was simply cystic or whether malignant growth also was present. Similar conditions were present in the second case except that the lower segment of the cyst was viable and protruded from the renal hilus. When the cyst was opened, uncontrollable bleeding was encountered from a large vessel in the deeper portion of the cyst. An attempt was made to control the bleeding by packing and suturing without success, and it was necessary to remove the kidney. On examination of the kidney after removal a fairly large ruptured blood vessel was found in the cystic cavity. In both kidneys there was evidence of previous inflammation, a probable causative factor in the formation of lymphatic cysts.

The effect of removal of the cysts on the elevated blood pressure was of interest. Apparently the cysts were so located as to cause a partial constriction of the renal artery, a condition which has been shown by experiments of Goldblatt and others to cause renal ischemia and hypertension. The fall in blood pressure followed immediately after operation, and while



the line of contact of the incised surfaces and an afflux of red and white blood cells together with degeneration of the tubules and glomeruli in the environs. All these changes lost in intensity as the distance from the line of incision increased.

In one specimen of a partially nephrectomized kidney from a patient who died of shock 24 hours after operation the described changes were present but the degenerative manifestations were much more marked and at a much greater distance from the incised surfaces. In this case an electric scalpel had been used to make the incisions.

Complete histologic description of the entire process of injury and repair is not given but only those processes which might throw some light on the subject under discussion are considered.

JOHN W. BRENNAN, M.D.

**Transvaginal Ureterorectal Anastomosis.** HERBERT D. WOLFF, Jr. *J. Urol. Balt.* 1945, 59, 18.

The author stimulated by the work of Hanner and Shaw on ureterorectal anastomosis with cystectomy, decided to apply that technique in a patient having an infiltrating malignancy of the trigone of the bladder.

The patient was a 73 year old white nullipara who complained of gross hematuria. Cystoscopy revealed an ulcerated lesion of the trigone measuring 3 by 2 cm. with levated nodular edges. It extended to within 1 cm. of the right ureteral orifice and 1.5 cm. of the left ureteral orifice when the bladder was distended and involved the vesical orifice from 5 to 8 o'clock. There was also a separate pedunculated papillary tumor located at 9 o'clock near the vesical orifice. The papilloma was removed with the resectoscope and biopsy of the trigonal ulcer revealed a grade III infiltrating epidermoid carcinoma. The rest of the patient's "work-up" was essentially normal.

Preoperative preparation included daily catharsis, a low residue diet with concentrated carbohydrates and vitamins, and sulfasuxidine orally.

Operation was performed on May 4, 1946. Transvaginal ureterorectal anastomosis with partial cystectomy was done under spinal anesthesia. A midline epiflotomy was done for exposure. The cervix was pulled down. Young's prostatic retractor was inserted through the urethra and gave traction. The urethra was dissected free and the anterior vaginal incisions were made elliptical to allow removal of the vaginal vault beneath the tumor. The anterior bladder wall, dome and lateral walls were freed with surprising ease. The anterior bladder wall was then incised transversely to expose the tumor and ureteral orifices. The ureters were easily catheterized and drainage was good. The transverse incision was extended to leave a cuff of bladder wall around the left ureteral orifice but it was made close to the lower edge. Thus, the bladder neck and urethra were amputated. The right ureter was cut at the ureterovesical junction. All of the liberated bladder was excised, but the posterior wall was allowed

to remain. This residual portion was to be excised if time permitted or used as the anterior vaginal vault. The rectum was then exposed by extension of the midline epiflotomy incision. The lateral vaginal walls near the cervix were tunneled under by blunt dissection, and the ureteral catheters which had been tied in the ureters were grasped and brought down. The muscularis was separated and the rectal mucosa exposed at the sites selected for anastomosis. A short proctoscope was passed the mucosa incised left and right and the catheters were passed through the proctoscope. The ureters were drawn into the rectum and anchored with the usual transfixion sutures and with sutures of 00 chromic catgut to the muscularis. The remaining posterior bladder wall fitted into the anterior area of the excised vagina. It was sutured in place and the posterior vaginal wall was then resutured. The epiflotomy was closed.

The operation took 2 1/2 hours and was tedious but not as difficult as had been anticipated.

The postoperative course was essentially uncomplicated. The patient received penicillin and transfusions, and was kept on an acid ash diet. Both ureteral catheters drained perfectly and they were left in until they came out spontaneously on the eighteenth postoperative day. An intravenous urogram showed a normal right urinary tract and a moderately dilated left one. Anal control was fair and the patient left the hospital 1 month after the operation.

Two and one half months postoperative she noticed leakage of urine from the vagina in small amounts. An intravenous urogram revealed a normal right urinary tract but no dye appeared in the left pelvis or ureter in 60 minutes. Proctoscopy showed a small hyperemic mound in the area of the right ureteral transplant with urinary drainage. The left ureteral orifice was represented by a small dimpled orifice just within the anus. Catheterization of the left ureteral orifice was at first unsuccessful. Finally a No. 4 F. form was passed and dilated to No. 8. Following this dilatation and drainage there was no reaction and the urinary leakage ceased at once. Subsequently the left ureteral orifice was dilated every 2 to 3 weeks up to a No. 12 bulbed catheter to which resistance was marked. At no time was the dilating catheter passed more than 6 to 8 cm. up the left ureter and neither lavage nor retrograde pyelography was done. The urinary stasis decreased as did the amount of pus in the urine. The anterior vaginal wall was found to be bulging into the vaginal orifice with localized edema. This was controlled with a small doughnut pessary.

Re-examination in February 1947, after the pessary had intentionally been left out for 3 weeks, revealed the anterior vaginal wall herniating through the vaginal orifice with localized bleb edema. Indigo carmine given intravenously appeared in fair concentration from both ureterorectal orifices in 10 minutes. An intravenous urogram showed fairly normal upper urinary tract.

From his experiences with this case the author feels that transvaginal ureterorectal anastomosis in the

female with normal vaginal structures is possible. The advantages of the approach seem to be (1) an easier single stage procedure with minimum shock (2) an extraperitoneal approach with safety from peritoneal infection and from intestinal obstruction (3) the accessibility of the lower ureters for trans rectal instrumentation and (4) the reserve possibilities of a secondary transvaginal ureterorectal anastomosis or ureterosigmoidostomy if the primary procedure is unsuccessful. He states that further experience will be necessary to establish these advantages and feels that the procedure is worthy of consideration in certain cases of urinary incontinence, vesicovaginal fistula, elusiv ulcer and for tumors of the bladder neck and urethra.

ROBERT O. BEADLES, M.D.

Modern Concepts of Ureteral Calculi. CHARLES C. HIGGINS and J. G. WARDEN. *Ann. Surg.* 1948 127: 257

The authors review a series of 256 cases of ureteral calculi for the purpose of comparing the method of treatment instituted with that used in previously reported series. The present article is a supplementary report on ureteral calculi treated at the Cleveland Clinic, Cleveland, Ohio during the period from 1930 to 1945.

It is generally accepted that no single etiologic factor is responsible for the formation of the calculi; therefore, in view of our present knowledge the following factors must be studied: (1) hyperparathyroidism, (2) vitamin A deficiency, (3) stasis, (4) metabolic diseases, (5) focal infection and (6) in infections of the urinary tract.

In 69 per cent of the cases the condition occurred between the ages of 21 and 50; 79 per cent of the patients were men and 21 per cent were women. In 47 per cent of the patients the calculi were located in the right ureter and in 53 per cent in the left ureter. Bilateral ureteral calculi occurred in 17 to 3.6 per cent of the cases. The majority of calculi were found to be impacted in the pelvic portion of the ureter.

Pain was the predominant symptom. It occurred as colic in 59 per cent of the patients, as unilateral costovertebral-angle pain in 20 per cent, as indefinite abdominal discomfort in 22 per cent and as nausea and vomiting in 36 per cent of the patients.

Calculi in the upper ureter produce pain either as a colic radiating around the abdomen to the epigastria or by obstruction produce a fixed sharp or dull pain in the posterior renal area. Stones in the pelvic portion of the ureter may produce colic, obstructive symptoms and also pronounced vesical symptoms. During the attack nearly half of the patients in the series noted frequency; urgency was present in 31 per cent. Microscopic hematuria was present in 82.8 per cent of the patients and gross hematuria in 36.7 per cent. Microscopic pus was present in 89 per cent.

Ninety-eight per cent of stones were demonstrated roentgenologically. Intravenous urography has become an important diagnostic aid. In addition to demonstrating opaque and nonopaque stones, a

physiologic picture of renal function is secured thereby fixing an index of the proper therapeutic course to be followed.

Few urologic problems require consideration of so many factors as does an obstructing ureteral calculus. Whether to operate or manipulate is the question arising in every case. The economic status of the patient and his occupation may influence the procedure to be advocated. A sudden attack of colic in persons working as airplane pilots, engineers, etc., may endanger the lives of those dependent upon them. Repeated attacks of colic in a laborer may result in a greater loss of working time than if surgical removal was done.

The size of the calculus is of considerable importance as a general rule the larger the calculus the less likely it is to pass spontaneously, and the more frequently will manipulative efforts fail to succeed.

Any method of therapy should have as its prime objective the prevention of destruction or loss of function of the kidney on the affected side.

The general health of the patient is a factor inasmuch as some patients are more susceptible to febrile reactions following manipulative procedures. In elderly patients associated pathological conditions such as prostatic hypertrophy make manipulative procedures technically difficult and febrile reactions are more likely to occur. In small children because of technical difficulties open operation is usually the procedure of choice.

In the authors' experience the use of single or multiple catheters has been most successful with minimal complications. They believe that mechanical stone removers should be restricted to use on stones in the lower third of the ureter. Stones of the upper and midureter are in the absence of complications treated by a policy of watchful waiting. If the calculus is 1 cm. in diameter or less and is moving spontaneously down the ureter manipulative treatment is delayed until the stone reaches the pelvic portion then the use of multiple catheters or a basket extractor is advised. If the stone in the mid or upper ureter is producing complete obstruction then surgical intervention is advocated.

Spinal anesthesia is the anesthesia of choice for the surgical removal of stones from the ureter. Immediately before operation it is advisable to check the location of the calculus roentgenographically.

A muscle-splitting operation and extraperitoneal approach are utilized in removing stones from every point of the ureter.

In the authors' experience operation has been resorted to for the following reasons: (1) repeated failure of manipulative methods, (2) impassable obstructions due to stones that cannot be moved, (3) renal infections which endanger the life of the patient by temporization, (4) associated disease which makes instrumental attempts technically impossible, (5) upper urinary tract disease which itself requires surgery, and (6) in patients who cannot tolerate transurethral manipulation. In conclusion the authors state that investigation of the numerous etiologic



the line of contact of the incised surfaces and an afflux of red and white blood cells together with degeneration of the tubules and glomeruli in the environs. All these changes lost in intensity as the distance from the line of incision increased.

In one specimen of a partially nephrectomized kidney from a patient who died of shock 24 hours after operation, the described changes were present but the degenerative manifestations were much more marked and at a much greater distance from the incised surfaces. In this case an electric scalpel had been used to make the incisions.

Complete histologic description of the entire process of injury and repair is not given, but only those processes which might throw some light on the subject under discussion are considered.

JOHN W. BRENNAN, M.D.

**Transvaginal Uterorectal Anastomosis.** HUNNER  
D. WOLFF JR. *J. Urol. Balt.* 64:3, 59 8

The author stimulated by the work of Hunner and Shaw on uterorectal anastomosis with cystectomy decided to apply that technique in a patient having an infiltrating malignancy of the trigone of the bladder.

The patient was a 73 year old white nullipara who complained of gross hematuria. Cystoscopy revealed an ulcerating lesion of the trigone measuring 3 by 2 cm. with elevated nodular edges. It extended to within 1 cm. of the right ureteral orifice and 1.5 cm. of the left ureteral orifice when the bladder was distended and involved the vesical orifice from 5 to 8 o'clock. There was also a separate pedunculated papillary tumor located at 9 o'clock near the vesical orifice. The papilloma was removed with the resectoscope and biopsy of the trigonal ulcer revealed a grade III infiltrating, epidermoid carcinoma. The rest of the patient's work up was essentially normal.

Preoperative preparation included daily catharsis, a low residue diet with concentrated carbohydrates and vitamins, and sulfasuxidine orally.

Operation was performed on May 4, 1946. Transvaginal uterorectal anastomosis with partial cystectomy was done under spinal anesthesia. A midline episiotomy was done for exposure. The cervix was pulled down. Young's prostatic retractor was inserted through the urethra and gave traction. The urethra was dissected free and the anterior vaginal incisions were made elliptical to allow removal of the vaginal vault beneath the tumor. The anterior bladder wall, dome and lateral walls were freed with surprising ease. The anterior bladder wall was then incised transversely to expose the tumor and ureteral orifices. The ureters were easily catheterized and drainage was good. The transverse incision was extended to leave a cuff of bladder wall around the left ureteral orifice but it was made close to the lower edge. Thus, the bladder neck and urethra were amputated. The right ureter was cut at the uterorectal junction. All of the liberated bladder was excised but the posterior wall was allowed

to remain. This residual portion was to be excised if time permitted or used as the anterior vaginal vault. The rectum was then exposed by extension of the midline episiotomy incision. The lateral vaginal walls near the cervix were tunneled under by blunt dissection and the ureteral catheters which had been tied in the ureters were grasped and brought down. The muscularis was separated and the rectal mucosa exposed at the sites selected for anastomosis. A short proctoscope was passed, the mucosa incised left and right and the catheters were passed through the proctoscope. The ureters were drawn into the rectum and anchored with the usual transfexion sutures and with sutures of 00 chromic catgut to the muscularis. The remaining posterior bladder wall fitted into the anterior area of the excised vagina. It was sutured in place and the posterior vaginal wall was then re-sutured. The episiotomy was closed.

The operation took 2 1/2 hours and was tedious but not as difficult as had been anticipated.

The postoperative course was essentially uncomplicated. The patient received penicillin and transfusions, and was kept on an acid ash diet. Both ureteral catheters drained perfectly and they were left in until they came out spontaneously on the eighteenth postoperative day. An intravenous urogram showed a normal right urinary tract and a moderately dilated left one. Anal control was fair and the patient left the hospital 1 month after the operation.

Two and one-half months postoperative she noticed leakage of urine from the vagina in small amounts. An intravenous urogram revealed a normal right urinary tract but no dye appeared in the left pelvis or ureter in 60 minutes. Proctoscopy showed a small hyperemic mound in the area of the right ureteral transplant with urinary drainage. The left ureteral orifice was represented by a small dimpled orifice just within the anus. Catheterization of the left ureteral orifice was at first unsuccessful. Finally a No. 4 B form was passed and dilated to No. 8. Following this dilatation and drainage there was no reaction and the urinary leakage ceased at once. Subsequently the left ureteral orifice was dilated every 3 to 5 weeks up to a No. 11 bulbous catheter to which resistance was marked. At no time was the dilating catheter passed more than 6 to 8 cm. up the left ureter and neither lavage nor retrograde pyelography was done. The urinary stasis decreased as did the amount of pus in the urine. The anterior vaginal wall was found to be bulging into the vaginal orifice with localized edema. This was controlled with a small doughnut pessary.

Re-examination in February 1947 after the pessary had intentionally been left out for 3 weeks, revealed the anterior vaginal wall herniating through the vaginal orifice with localized bleb edema. Indigo carmine given intravenously appeared in fair concentration from both uterorectal orifices in 10 minutes. An intravenous urogram showed a fairly normal upper urinary tract.

From his experiences with this case the author feels that transvaginal uterorectal anastomosis in the

are of three general types (1) fibrous contractures or bars (2) intravascular hypertrophy, and (3) subvesical enlargement the last two may exist in combination.

Several years ago the author called attention to the fact that a certain danger existed in the period of preoperative preparation and that a mortality occurred which in many instances could be attributed to infection initiated by urethral instrumentation often arising from the use of the indwelling urethral catheter. The use of suprapubic puncture was suggested as a safer procedure and subsequent and extended experience has fortified this attitude.

The operation itself is the least important phase of the patient's hospital sojourn and yet one must acknowledge its contribution to the safety of prostatic surgery. The older authors recognized three great dangers in prostatic surgery (1) shock (2) hemorrhage, and (3) uremia. The last of these has been largely overcome by proper preoperative study of renal function and preparation of the patient to improve and stabilize the kidney function. An associated factor of great importance is the avoidance and control of urinary infection which was all too often the immediate cause of the uremia.

Undue bleeding should first be combated by irrigation and blood transfusion, but one cardinal principle should always be observed namely, a bladder filled with clots must be emptied with the least possible delay. For this purpose the most certain and satisfactory method is to return the patient to the operating room where under pentothal anesthesia, the resectoscope is introduced and all clots evacuated.

The blood pressure must be carefully watched and any sudden or progressive drop promptly combated. The use of vasoconstrictor drugs may suffice for immediate use but in the case of shock blood must be available for transfusion. An available blood bank may thus become a potent safety factor.

The postoperative fluid intake must be properly maintained and in the days immediately following operation, reliance is placed mainly upon intravenous administration. Five per cent glucose in saline is employed in patients who have undergone prostatectomy at least 3,000 c.c. are given daily.

Urinary sepsis with ascending pyelonephritis has in the past accounted for a considerable number of fatalities. Previously the author has commented on the value of sulfonamides and antibiotics. Patients are given, routinely 20,000 units of penicillin every 3 hours along with 7½ gr. of sulfathiazole four times daily. This is discontinued on the fourth day unless particular indications demand continuance.

Epididymitis is controlled by vasectomy it is practically routine for patients having a prostatectomy but is rarely done in patients having transurethral resection because the incidence of epididymitis is very low.

Embolic episodes have long been a much dreaded complication of prostatic surgery. Thrombophlebitis which involves the veins of the legs is rarely encountered and it is believed that emboli originate more often from the periprostatic and deep pelvic

veins. The author prefers to treat thrombophlebitis with the anticoagulants. Heparin is used if immediate response is imperative dicumarol is used in less urgent cases and for those in which prolonged treatment seems desirable.

JOHN A. LORR, M.D.

**Torsion of the Appendix Testis.** WILLIAM M. CORPENTOR and LOUIS C. ROBERTS. *J. Pediatr.*, St. Louis, 1948 32: 184.

Acute painful swelling of the scrotal contents in young boys is seen infrequently. Injury or torsion of the spermatic cord accounts for the majority of cases. Torsion of the appendix testis though rare is seen sufficiently often to call for its consideration in the differential diagnosis in this group of cases.

The appendix testis is attached to the upper extremity of the testis just beneath the head of the epididymis. It is said to be present in 90 per cent of males and varies from 5 to 10 mm. in length. The structure is attached to the connective tissue investing the testis and consists of vascular connective tissue containing a canal lined with columnar epithelium. The appendices testes are in fact the persisting cephalic ends of the embryonic müllerian ducts which in the female develop into the oviducts uterus and most of the vagina.

Torsion of this small vestigial body produces symptoms often confused with other acute pathology of the scrotal contents or of intra-abdominal disease. The severity of the symptoms is usually out of proportion to what may be expected from so small an organ. The early symptoms may be lower abdominal or inguinal pain without scrotal signs. Later there is pain in the testicle with exquisite tenderness, edema of the scrotal tissues and redness of the skin. The temperature is usually normal and the laboratory findings are within normal limits.

Differentiation from torsion of the spermatic cord may be impossible and for this reason early surgical exploration should be done when either condition is suspected.

The authors submit a case report of torsion of the appendix testis.

ROBERT O. BRADLEY, M.D.

**Malignant Tumors of the Testis. Treatment at Radiumhemmet Stockholm.** HUGO AMBROW. *Acta radiol. Stockh.* 1947 25: 669.

Testicular tumors differ in several respects from other tumors occurring in humans. Tumors of this type have been of considerable interest to pathologists, surgeons and radiotherapists particularly in view of their rarity.

During the latter part of the nineteenth century a period of rapid progress in tumor pathology, a favored subject for theoretical discussion and study was that of mixed or teratoid tumors of the testis. This tumor group was often used as an argument for the support of various theories pertaining to tumors in general. Ribbert and Wilms were the most important contributors to the literature on testicular tumors during this period and their conception of this tumor group and its position in the system of

factors in each case of ureteral stone is important the plan of management for each case must be individualized, in their experience ureteral catheter manipulations are superior to mechanical stone extractors, although the latter are a valuable adjunct in many instances the current trend at Cleveland Clinic in the treatment of ureteral calculi is definitely toward conservative management by manipulation rather than by open surgery

ROBERT O. BEADLES, M.D.

### GENITAL ORGANS

Safety Factors in Prostatic Surgery WILLIAM J. EWELL, *Pennsylvania M J* 943, 51: 5: 2.

The author states that as an indication of the degree of safety achieved in prostatic surgery we may turn to the mortality statistics. In a series of 1,997 patients there were 35 operative deaths, a mortality of 1.63 per cent. Of 1,903 transurethral resections there were 31 deaths, a mortality of 1.55 per cent. Since the safety factors of which the author speaks evolve gradually and cannot be said to apply to the entire series it seemed of interest to observe whether or not their adoption had favorably influenced the mortality rate. The cases of transurethral resection were accordingly divided into two equal periods of 8 years each, one from 1931 to 1938 inclusive, the other from 1939 to 1946. During the first period 744 patients were operated upon with 25 deaths, a mortality of 3.3 per cent, while in the later period, 459 patients were operated upon with 6 deaths, a mortality of 1.3 per cent. Of the prostatectomies, 93 one-stage operations were performed with 3 deaths, a mortality of 3.15 per cent. The majority of these were performed during the second period, because the early enthusiasm of the author for transurethral resection led him to perform this operation in all cases.

Before proceeding to the contribution of the urologists to the safety of prostatic surgery there are certain other factors which should be recognized. Perhaps the greatest of these is removal of the patient's fear of both hospital and operation. It is a tribute to surgical progress in general, and to improved techniques in prostatic surgery in particular that today patients with prostatic obstruction accept recommendation for operation readily and with confidence in the successful outcome.

As a result of acceptance of operation, the patient submits to operation at an earlier stage of his disease, in better general condition, often with satisfactory renal function, and in every way a better risk.

A second factor of immeasurable value is the part played by the sulfonamides and antibiotics in the control of urinary tract infections. Alone or in combination they may be required during the preoperative preparation to combat an existing infection and may be lifesaving in the postoperative period.

The author's experience with Bacillus coli infections of the urinary tract has repeatedly demonstrated the great value of streptomycin which is

given at present in somewhat larger doses, starting with 4 gm. the first day decreasing the dose to 2 gm. a day and continuing this dosage until the infection is controlled.

A safety factor in prostatic surgery which is often overlooked, is the assistance of a well trained and alert house staff of resident physicians and nurses.

Many a tragedy has been averted by prompt attention to unexpected or excessive bleeding, the institution of measures to combat fall in blood pressure, the judicious and frequent administration of intravenous fluids or blood transfusion and countless other attentions which require prompt and rational action. There are few operations which require such close attention for the first 24 to 48 hours as those for prostatic obstruction, and anyone who boasts a low mortality rate owes a large debt to the hospital staff.

The surgical experience of the patient with prostatic may be divided into three phases: (1) preparation, (2) operation and (3) recovery. Of these, preparation is the most important.

A careful history and general examination of the patient has long been the accepted practice. One may however emphasize the importance of cardiovascular evaluation, and if the history is at all suggestive, an electrocardiogram and cardiac consultation are desirable. This is of importance not only in judging the operative risk but also in selecting the anesthetic agent and method.

The importance of evaluating renal function has long been recognized. It should be emphasized, however, that blood chemistry studies alone are not a safe criterion for evaluating the functional status of the kidneys or for determining if and when the patient is ready for operation. Several instances could be cited in which the blood urea did not exceed normal figures and yet the urogram revealed delayed function with pronounced bilateral hydronephrosis and hydroureter a condition demanding preliminary drainage.

The procedure which, in the author's opinion, constitutes the most important and valuable single examination contributing to the safety and proper planning for the patient with prostatic disease is intravenous urography. No other single examination supplies as much information, for from it may be determined (1) renal function, (2) type of prostatic and selection of operation (3) preoperative management, and (4) estimate of risk.

The author believes that the procedure which may be relied upon to replace other tests of renal function, is that of making the x-ray exposures at 5 minute, 15 minute, 30 minute, and 1 hour intervals after the injection of diodrast. A fractional function is thus obtained. Although the interpretation of the series of urograms is only a gross method of studying renal function, it has been found to agree well with other laboratory methods.

Determination of the type of prostatic, upon which selection of operation depends, can be made from interpretation of the cystogram shadows of the series of urograms. The benign vesical neck obstructions

treatment. Practically no information regarding the prognosis was obtained from prolan tests made in 59 cases. Blood sedimentation tests seem to be of particular prognostic value in this tumor group

JOHN E. KIRKPATRICK M D

**Management of Carcinoma of the Prostate.** JOSHUA C. BIRDWELL. *J Urol* Balt. 1948, 59 320.

The incidence of carcinoma is reviewed and the figures of Young Rich and Moore are mentioned. Young found prostatic carcinoma in 21 per cent of patients with prostatic obstruction at 292 consecutive autopsies in males over 50 years. Rich observed carcinoma in 14 per cent and Moore reported an incidence of carcinoma at autopsy in 16.7 per cent. The author has not reported cases of patients less than 44 years of age. The author states that an intelligent prostatic examination must be an essential part of every health examination in the male, to be executed at yearly intervals after the age of 40.

The diagnosis of early prostatic carcinoma is difficult, but in the author's series of 52 patients the disease arose in the posterior lobe in 66.1 per cent. The value of the Silverman biopsy needle is mentioned as an aid to early diagnosis of prostatic carcinoma and has the advantage of being an office procedure.

The value of an elevated acid phosphatase study is mentioned and particularly when sodium beta-glycerophosphate is used as the substrate.

With regard to therapy it is pointed out that Huggins' estrogenic therapy affords a great palliative measure in inoperable prostatic carcinoma, but there has been no evidence of cure following this method of treatment. In the author's series of 15 patients who were afforded the combined therapy of orchiectomy and estrogens the longest survival period was 27 months as compared to 36.2 weeks in a group of 739 patients not so treated. The author advocates 0.05 mgm ethinyl estradiol daily for 30 days followed by a 30 day rest period before further medication.

In considering the treatment of prostatic carcinoma, the author mentions the importance of early diagnosis and radical prostatectomy. Young reported a cure in 20.6 per cent of his patients. George Gilbert Smith reported cure in 29.5 per cent and Elmer Belt reported an apparent cure in more than 50 per cent. Furthermore, Smith found that only 20 per cent of patients seen were suitable for radical prostatectomy, and Barringer saw only 5 per cent of the patients in his series early enough to permit radical surgery.

ROBERT LICH, JR., M D

# MISCELLANEOUS

**Persistent Cloaca.** WILLIAM J. BAKER and J. LESTER WILKEY. *J Urol* Balt. 1948, 59 643.

The authors report the case of a 5 year old male who entered the Cook County Hospital Chicago Illinois, because he voided all his urine by way of the bowels. There was no history of congenital anomalies in any other member of the family. The patient had two liquid bowel movements a day.

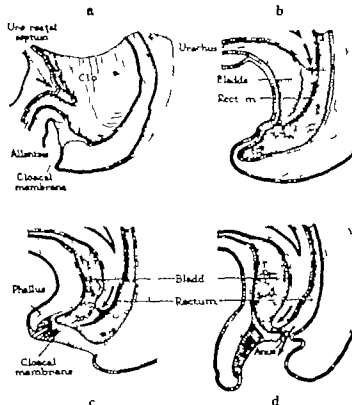


Fig 1 (Baker and Wilkey) a, Shows the dilated caudal segment of the bowel the cloaca the allantois empties into this structure. It also shows the cloacal membrane which is a thin wall of ectoderm and endoderm. b and c, In a 6 weeks embryo the urorectal septum a frontal fold, passes downward to meet the cloacal membrane and separates the cloaca into a dorsal rectal and a ventral urogenital segment, from the dorsal surface of which the ureter stalks and wolffian ducts leave. The upper portion of this anterior or ventral segment becomes the bladder the inferior portion becomes the posterior urethra in the male and the entire urethra in the female. d, It is believed that in this patient the urorectal septum never completely joined the cloacal membrane, which fact established a connection between the bladder and rectum thus, a persistent cloaca is present.

The penis was very rudimentary and the testes were of normal size for a boy 5 years old. Intravenous urograms showed normal bilateral kidney function and a urinary bladder which filled with dye. Proctoscopic examination revealed a rosette of mucosa on the ventral wall just inside the anal sphincter. This was interpreted as a stoma or connection between the bladder and the rectum. It was believed that in this patient the urorectal septum never completely joined the cloacal membrane which established a connection between the bladder and the rectum. There was no evidence of a urethra, but the ureters apparently emptied into their usual location in the bladder.

Since the child was in good health in spite of the persistent cloaca and since it was doubtful whether surgery would improve that which nature had already done it was decided not to use any operative interference in an effort to correct his defects.

JOSEPH E. MAURER M D

tumor pathology is still, for the most part, accepted by the majority of authors in this field.

In the early years of the present century Chevasu in France, and later Ewing in the United States completed the modern doctrine of testicular tumors, especially with regard to the pathogenesis, histologic classification and clinical characteristics. Chevasu gave a very good and comprehensive histologic and clinical description of these tumors. He also clearly defined the interesting and quantitatively most important subgroup and gave it the name of seminoma. He considered the origin of tumors of the testis to be the cells of the specific sex epithelium. Ewing's classification is still used by many authors, especially in America. Many pathologists and clinicians use a more or less modified Ewing classification. Ewing considered all such tumors to be mixed tumors for instance, in the case of the seminoma, the epithelial cells were supposed to have completely overgrown the other elements.

The numerous articles dealing with this subject during the last 30 years have added to our knowledge in two ways. First the methods of treatment—surgical as well as radiological—have been gradually improved and the late results have been correspondingly more satisfactory. Secondly the investigations about hormonal excretion in cases of tumors of the testis (Zondek since 1929 and others) have opened a new field of research. At least, according to some authors (Ferguson, Bang, Hamburger and Nielsen and others) the last mentioned research work has already led to practical results, particularly as an aid in the evaluation of the prognosis and the therapeutic results.

Besides the special features mentioned (concerning pathology and endocrinology) the following clinical characters are of particular interest:

1. The average age of the patients is unusually low. Most authors agree that practically all patients are within the age group of 30 to 50 years.

2. Trauma as an etiologic or predisposing factor has been considered by several authors of more importance in tumors of the testis than in most other types of tumor. The frequency of trauma in the author's material was 5 per cent. Trauma to the testes is not at all unusual and, being rather painful, is not so easily forgotten by the patients, even if relatively slight. The frequency of trauma among patients with testicular tumor does not seem to be high enough to be anything but incidental.

3. Retention of the testicle is a definite statistically proved predisposing factor. According to Grevillius, who made a survey of the contributions to this question in the literature tumors occur 40 times more frequently in abnormally than in normally situated testicles. The average frequency of testicular retention in the published series by Grevillius was found to be 13 per cent. Exactly that frequency was also found in the author's material. In both series, cryptorchidism was relatively more frequent in the seminoma subgroup than in other types of tumor.

4. Gynecomastia in general is a relatively rare condition. It is seen mostly during and soon after puberty and often as a one-sided hyperplasia. In the form of ductal fibroadenomatosis it also occurs in men of relatively advanced age (50 to 60 years), sometimes bilaterally. In the last mentioned cases the condition must be considered as a precancerous one. Among male patients, gynecomastia is otherwise seen only in those with tumors of the testis and in those with carcinoma of the prostate who have been treated with female hormones over a long period of time.

5. The radiosensitivity of the seminomas is considered to be high by all authors of recent papers. The other microscopical types of tumors of the testis, on the other hand, are usually said to be only slightly radiosensitive.

6. Metastases of malignant tumors occur (if the patient is not cured at an early stage) in the upper para-aortic lymph nodes, the typical "first station," and in the left supraclavicular lymph nodes. Metastases in lungs, pleura, mediastinal lymph nodes, skeletal system etc. were found only in rare cases, on clinical examination.

Inguinal metastases, also are rare a fact which seems to be much better known now than it was 10 to 15 years ago, when patients were sometimes seen who had received inguinal irradiation only after orchiectomy.

Among the numerous methods of treatment described in the literature three main principles may be distinguished:

1. Radical surgery including removal of the retroperitoneal lymph nodes. This difficult operation has been worked out by Chevasu and Ilmman and is in use at a few clinics, probably only for the less radiosensitive tumor types. The radical operation is sometimes combined with postoperative roentgen treatment.

2. Simple orchiectomy usually followed by roentgen irradiation. This method seems to be favored by the majority of recent authors, especially in cases of seminoma.

3. Primary irradiation either routinely as a preoperative treatment followed later by orchiectomy or in the case of radiosensitive tumors, without surgical intervention.

At Radiumhemmet the principle of orchiectomy followed by roentgen treatment of the upper para-aortic lymph nodes has always been applied.

From 1922 to 1941 inclusive, 119 patients with malignant tumors of the testis were treated. The 5 year cures for the whole series amounted to about 50 per cent for those without metastases about 70 per cent. Of those with seminomas, 65 patients (65%) had 5 year cures, and among those with adenocarcinomas and malignant mixed tumors, 44 patients (35%) had 5 year cures. Among those with seminomas without metastases, the 5 year cure rate was about 80 per cent. Orchiectomy and postoperative roentgen treatment, chiefly on the para-aortic lymph nodes, is considered the best method of

# GENTOURINARY SURGERY

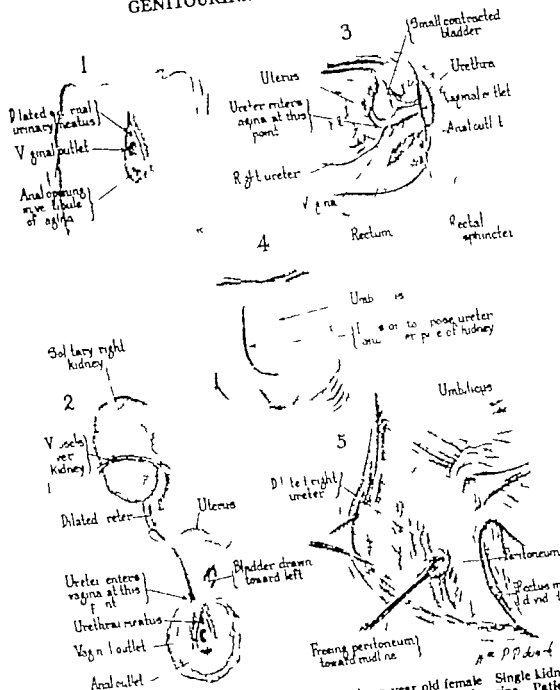


Fig. 2. Case 2 (Lowaley). Congenital anomaly 7 year old female. Single kidney (right) with ureter opening into vagina. rectal outlet in vestibule of vagina. Patient had fecal control but urinary incontinence. 1 View of dilated ureter, vaginal outlet and anal opening in vestibule. 2 Reconstruction of condition found at operation. Solitary (right) kidney with dilated ureter opening into vagina. 3 Sagittal view showing insertion of ureter into vagina and position of rectal outlet in vestibule. Rectal sphincter muscles present in normal position. 4 Skin incision to expose ureter and lower pole of kidney. 5 Exposing dilated ureter.

but the ureter from the patient's single (right) kidney was aberrant, opening into the wall of the vagina, and was incontinent and hence she was constantly wet.

The condition prior to operation and the operation are well illustrated in this article.

In conclusion the author believes that extensive surgical procedures necessary to accomplish correction of a persistent cloaca were justified because of the psychological changes that took place following

correction of this anomaly. These patients can be rehabilitated and surgery should be done before the child reaches school age. CONRAD A. KUZEM M D

Wartime Injuries of the Urinary Tract D S POOLE WILSON RICHARD MCGO, and GEOFFREY PARKER. *Brit J Urol.* 1947 19 190.

A total of 81 patients were seen at a British genitourinary center during the war. Almost invariably suprapubic cystostomy was done. In relatively few

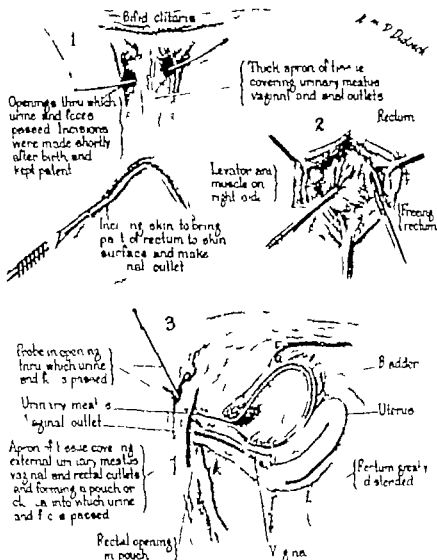


Fig. 1 (case Lowry). Congenital abnormality in 9 year old female operative restoration. Rectum opened into vaginal vestibule (cloacal pouch) which was covered at birth by apron of tissue opened by obstetrician thru it tabounds through which urine and feces passed. Condition present apron of tissue covers urethral, vaginal and rectal outlets. Sd. Incision to expose portion of rectum and make new anus. Freeing rectum. 3. Sagittal view of condition present.

Peristaltic Cloaca. OSWALD S. LO SLIP J. Lral  
Balt. 948 59: 69

Persistent cloaca in the human is probably the rarest of all developmental defects. Only 5 cases in which the treatment was surgical have been reported in the literature. The author reports 2 cases of persistent cloaca in young females (one 9 years of age and the other 7 years of age) in whom the condition was corrected by operation.

The human embryo passes through a period during which, like birds and reptiles, it has a common cloaca for both feces and urinary excretion. It seems

strange to the author that persistent cloaca was not found more often. The cases described were true cloacas because both feces and urine emptied into cloacal type of pouch and emanated from this pouch through the same aperture.

In the first case both ureters emptied into a continent bladder but there was overflow incontinence as the bladder was absolutely untrained and without sensation. The rectum opened into the vestibule of the vagina (cloacal pouch).

In the second case the rectum opened into the lower part of the vaginal vestibule and was continent

# SURGERY OF THE BONES, JOINTS, MUSCLES, TENDONS

## CONDITIONS OF THE BONES, JOINTS, MUSCLES TENDONS ETC.

Trauma to the Region of the Bursa Anserina  
CHARLES J. SUTRO *Am J Surg* 1948 75 489.

The bursa anserina is located superficially to the tibial collateral ligament on the upper medial surface of the tibia. The bursa is enclosed by the tendons of the sartorius gracilis and semitendinosus.

The observations of the author were based on a study of 3 soldiers who had suffered injuries from the hoof of an animal while participating in military training. Persistent local pain and swelling were present along the inner aspect of the proximal portion of the leg the pain over this area was severe when the leg was fully flexed against active resistance.

In 2 cases treatment consisted of hospitalization with bed rest, and warm or cold compresses whirl pool baths infrared irradiation and nonweight bearing quadriceps exercises gave relief. The third patient, who was seen 44 days after injury had a swelling the size of a small lemon. He did not respond to conservative treatment. Exploration revealed that the mass consisted of a subcutaneous adventitious bursa which had a direct channel to the cavity of the contiguous bursa anserina.

DANIEL H. LEVINTHAL, M.D.

Concerning the Pathology and Treatment of Tennis Elbow J. R. S. LAHAY *Med J Australia* 1947 2 737

Following a detailed review of anatomical considerations in the disability described as tennis elbow the author presents his view of the pathologic changes. A painful localized synovial reaction occurs as the result of either direct trauma or trauma due to muscle play. This reaction may be acute and stormy, but in many cases it passes on to a chronic stage of inflammation. The neighboring capsule and muscles, which are the original cause become secondarily involved and in rare cases, the peroneum. As in synovitis of the knee, adhesions in the synovial membrane may eventually form and fibrosis may occur in the muscles. Unresolved, inflamed and persistently irritated membranes may undergo patchy thickening. This thickening probably accounts for the occasional click felt when the radius is rotated and flexed. In view of the presence of such chronic inflammation in the near neighborhood of the periosteum occasional paraepicondylar ossification is not surprising.

Avoidance of the provocative cause for some weeks often effects a cure in the milder cases. In the more pronounced lesions immobilization in a plaster spica including the wrist and elbow with the elbow almost fully extended is indicated. The wrist is cocked up and the fingers are left free. In less acute cases a hand and finger platform splint is used—the wrist

with the semiflexed fingers being cocked up and the elbow being kept flexed in a sling. A strong sedative is indicated in the fulminating cases. Three weeks rest in spica or splint is followed by 1 week in a simple wrist cock up splint. This treatment seldom fails to produce a cure or to benefit the patient greatly. During the splint or plaster treatment, prophylactic shoulder and finger exercises should be carried out.

In chronic cases manipulation is worth trying. Manipulation is ill-advised if the disease is acute and in any case cannot be expected to effect a cure unless adhesions are present.

While injection treatment with a local anesthetic agent has had quite a vogue, the author does not consider it favorably.

Deep roentgen therapy is strongly recommended, especially in Germany theoretically this method of treatment should hold out some hope of success and warrants a wider trial.

If conservative treatment fails operative attack is well worth while in the small percentage of patients needing such operation.

The aim of operation should be to treat the underlying abnormality. The author prefers arthrotomy for which the elbow should be kept flexed and the forearm supinated for in this position the radiohumeral joint is most easily inspected. The tendon is exposed then keeping medial to the base of the epicondyle, the surgeon makes a slightly oblique cut towards the joint. With a blunt dissector the synovial pouch is pushed away from the epicondylar region toward the center of the joint. Synovial tags or thickening are removed a special search for these being made in the epicondylar region and in the line of the radiocapital joint. Meniscuslike projections are excised. In the author's cases, two chromicized sutures were used in the superficial part of the musculotendinous mass and the deep part was left gaping. The synovial membrane is not sutured.

The elbow is then encased in a plaster spica for 1 week after which gradually increasing exercises are taken with intermittent use of a sling.

In all cases cure has been immediate. Once cured, tennis elbow rarely recurs. Successful operations have the common factor of easing tension in the radiohumeral joint.

RUDOLPH S. REICH, M.D.

Lesions of Vertebral Bodies. JOSE VALLS, CARLOS E. OTTOLENGHI, and FRITZ SCHARJOWITZ. *J Am Med Ass.*, 1948, 136 376.

The authors describe the equipment and technique required for aspiration biopsies of the vertebral bodies, the indications for and the end results obtained with the use of the method in 86 cases.

A long double needle, somewhat similar to a spinal tap needle, is employed, and a guide is used to aid in the proper placement of the needle. Not all parts of the spine are accessible to puncture. The



cases was any attempt made at the primary operation to repair the urethra, other than the use of an indwelling catheter in cases of injury to the posterior urethra. The removal of foreign bodies, if present and the delayed suture of perineal wounds was carried out. When the urethra was completely ruptured repair was accomplished. The results were deemed satisfactory. Penicillin was used both intramuscularly and by local and urethral irrigation. The author states that in ideal surroundings one should often perform suprapubic cystostomy and a complete repair of the urethra at the primary operation, but that delayed suture of the urethral wound has been proved to give satisfactory results. In cases of complete rupture of the posterior urethra however alignment should be restored and maintained by means of an indwelling catheter at as early a time as possible.

The incidence of wartime bladder injuries was not more than 1 in 3,000 or 4,000. Two main groups of bladder injuries exist: (1) rupture due to sudden increase of internal hydrostatic pressure and (2) puncture of the bladder by foreign body or adjacent bone. The most important factor in the treatment of any bladder wound was the prevention of perivesical cellulitis which was achieved ideally by immediate su-

ture of the wound of the bladder wall and drainage of the perivesical cellular tissue. Suprapubic cystostomy was done. Perforation of the bladder per se usually caused comparatively little shock. Leakage of urine from the external wound was common but not invariable and if the diagnosis was in doubt, cystograms were made.

Of the 17 patients with renal injury it was found possible to preserve and repair the kidney in 9. The lacerations in the renal parenchyma were repaired with ordinary interrupted sutures of plain No. 1 catgut with strips of muscle interposed. When the renal pedicle was injured, light pressure by means of a rubber-covered clamp was applied to control the hemorrhage, while a careful dissection was performed. Often only one of the branches of the main vessel was involved, and a major portion of the kidney could be preserved.

Complete section of the lower ureter was considered best treated by reimplantation into the bladder when seen late. If this could not be done without tension then a flap of bladder could be turned up, fashioned into a sleeve and joined to the cut end of the ureter. For the upper lengths of the ureter transplantation into the colon was advised before resorting to nephrectomy. JONAS E. M. CRICK, M.D.

tures passed through it and the drill holes in the humerus. The sacs chosen for use in these cases were from chronic or recurrent hydroceles and had walls one-eighth of an inch thick. Presumably a chronic hernial sac would answer just as well.

No sepsis followed the operations (performed in 1944) and 6 months after operation the joints had about 60 per cent of normal flexion extension and rotation movements without pain with no instability whatever and with considerable power.

The following points in technique call for emphasis (1) careful asepsis is essential (2) the extent and method of bone resection give the new joint excellent stability (3) preservation of the attachments of the triceps and brachialis tendons gives one a long handicap in the early recovery of active muscular control of movement and (4) it is surmised that a peritoneal graft into a joint may be an adequate substitute for a lost synovial membrane.

RUDOLPH S. REICH M.D.

#### The Treatment of Dropped Shoulder A New Operative Technique. EMMET SPIRA. *J Bone Surg* 1948 30-A 229

The author believes that in some cases of severe paralysis of the shoulder and shoulder girdle muscles it is sometimes necessary to fix the scapula to the thorax. He has used three methods

1. Wiring of the scapula to the ribs. This has failed.
2. The lower end of the scapula is notched so as to fit over the rib at the proper level (in one case the sixth).
3. A hole is fashioned near the lower tip of the scapula and after a rib is divided and freed it is passed through this hole and the rib ends are re-fastened.

The last method only afforded rigid fixation.

The cases under treatment were complicated by a lack of control of the head. In both of them the chin lay on the chest and in the one the head deviated to the side. In both cases satisfactory control of the head developed after scapular fixation.

NEWTON C. MEAD M.D.

#### Experience and Results from Mobilizing Plastic Operations in 4 Cases of Osseous Ankylosis of the Knee II. STÖCKEN. *Acta orthop scand.*, 1947 17 146

Stability is very important to knee joint function and this is normally maintained by the ligaments and fibrous capsule. These soft tissues are usually destroyed by diseases or injuries which lead to bony ankylosis. Restoration of useful, painless motion without loss of stability is difficult, but the author believes the advantages of motion often justify the operation.

The function of the quadriceps is essential to a good result. An ankylosed patella offers a less favorable prognosis but does not contraindicate the operation. The technique of arthroplasty is as follows.

An anterior S shaped or Payr incision is used. The joint space is made largely at the expense of the

femoral condyles, so that with light traction one centimeter of space is present. The condyles are bevelled posteriorly so that very little of the posterior portion remains. A coherent fat flap from the abdomen is placed between the bony surfaces. In the 2 last cases Hassse's method of leaving a high intercondylar eminence was followed.

Postoperatively skeletal traction via the os calcis is applied with the knee flexed from 10 to 40 degrees over a Braun splint. Passive exercise is begun on the tenth day by having the patient move the pelvis up and down. On the twentieth day the leg is permitted to hang. The traction wires are not removed until the fifth week. The patient is allowed up in from 6 to 8 weeks.

In the 4 cases reported a useful knee resulted from this operation. Satisfactory flexion with weight bearing was obtained and complete or almost complete extension was present.

Some instability, pain on prolonged use, and crepitus were among the residual postoperative effects. The late roentgenograms show extensive degenerative changes in these joints, but pain free motion was present and could not be correlated with the roentgenographic appearance. The one patient who was reoperated upon following a poor result from arthroplasty with fascia lata over the bone surfaces showed that coalescence of the capsule and the thick layer of connective tissue which covered the tibia were the cause of stiffening after the first operation.

NEWTON C. MEAD M.D.

#### Fusion Operation for Bone and Joint Tuberculosis Associated with Multiple Tuberculous Foci. EMIL D. W. HAUSER. *Q Bull Northwest Univ M School* 1948 22 39

A series of 5 cases of multiple tuberculous infection with bone and joint foci is presented. The usual locations of the nonosseous tuberculosis were the lungs and the urinary tract. It was formerly a generally accepted principle that surgery of the bones and joints was contraindicated in cases of multiple tuberculous lesions. However with good preoperative care and long periods of convalescence it was possible to cure the osseous lesions by obtaining solid operative fusions of the affected joints which aided in the rehabilitation of the patient.

The author believes that the success of his treatment is related to the fact that all patients are treated on the basis that tuberculosis is a generalized disease.

VERNON C. TURNER M.D.

#### Conservative Surgery in Tumors of Bone with Special Reference to Segmental Resection. BRADLEY L. COLEY and NORMAN L. HIGGINBOTHAM. *Ann. Surg* 1948 127 231

The authors report 3 cases of tumors of the bone in patients who were treated by segmental resection and massive bone grafts. In 2 patients the middle third of the humerus was involved in 1 patient the middle third of the ulna was involved. In 1 case the tumor was a thrice recurrent central chondroma. In a

first three cervical vertebrae can be approached by the pharyngeal route the fourth, fifth, sixth, and seventh cervical vertebrae are accessible laterally. The posterior border of the sternocleidomastoid muscle is used as a guide to determine how far laterally to place the needle. The muscle must be kept anterior to the needle in order to protect the cervical vessels and nerves. Even if the finer inner needle punctures a vessel or organ such as the esophagus, the authors believe that little harm results, and they point to the great number of sympathetic blocks that have been performed without untoward effect. It is recommended that needle biopsy should not be attempted in the first 9 thoracic vertebrae which are in intimate contact with the descending aorta, the vena cava, the esophagus, and the thoracic duct. The tenth, eleventh, and twelfth thoracic vertebrae and the lumbar vertebrae are readily reached although it is apparent that one must follow quite accurately the technique described. The needle direction and position must always be checked by roentgen examination in two planes, prior to final placement.

Of the 86 patients on whom the procedure was performed it was possible to determine accurately the nature of the lesion in 59 (69%).

VERNON C. TURNER, M.D.

**Some Cases of Paravertebral Defects in the Anterior Portion of the Vertebral Body with Remarks on the Pathogenesis of the Lesions in Question**  
ARVID HELLSTADT. *Acta orthop scand* 947 7 50.

Eight cases showing a variety of defects of the anterior portions of the vertebral bodies adjacent to the intervertebral discs are presented and discussed. These cases include lesions similar to Schmorl's nodes, lesions presented by Scheuermann's disease and to so-called "persistent apophyses."

The author points out that these lesions are not due to tuberculosis or sepsis, despite the fact that there is often narrowing of the intervertebral cartilage. He does not consider them Schmorl's nodes because they are too anterior to be due to herniation of the nucleus pulposus; however he does believe that many of them represent compression and fracture of the vertebral body with displacement of the annulus fibrosus into the defect. This may be either a sudden process as the result of severe trauma, or it may be a gradual invasion of the vertebral body through a small traumatic defect or through vascular channels.

The author believes that the "persisting apophyses" are due also to the impaction of disc tissue and that this impaction is also important in the production of the defects seen in Scheuermann's disease.

The treatment depends on the severity of the symptoms. It varies from complete bed rest in the severe cases, to simple rest and physical therapy. Use is made of plaster casts and cloth corsets. Spinal fusion is sometimes indicated.

NEWTON C. MEAD, M.D.

## SURGERY OF THE BONES, JOINTS, MUSCLES, TENDONS, ETC.

**Transplantation of the Extensor Carpi Ulnaris to Give Abduction of the Thumb.** MICHAEL BEN-MAIM. *N York State J M* 918, 48, 363.

The author has devised an operation in which the tendon of the extensor carpi ulnaris is transplanted through the sheath of the abductor pollicis longus to give abduction of the thumb. The abductor motivates the withdrawal of the thumb from the palm to allow grasping, and the replacement stabilizes the base of the thumb to give better opposition.

The first incision, which is 1 inch long with the base of the first metacarpal at its center, exposes the long abductor tendon at its insertion. The second incision is over the distal two-thirds of the muscle and tendon of the extensor carpi ulnaris, extending proximally from the base of the fifth metacarpal. The tendon is freed, inserted, and passed through subcutaneous tunnel to appear in the first wound. Care is taken to free sufficient length of tendon and muscle so that the muscle may function freely in its new location. The tendon is passed without twisting and is anchored under neutral tension beneath a bone flap in the base of the first metacarpal bone, the thumb being held in wide abduction in the plane of the hand. The thumb is immobilized in abduction with plaster for 3 weeks before muscle re-education is started.

The operation is recommended particularly for the spastic hand in which the thumb lies across the palm due either to paralysis or stretching of the abductor pollicis longus. A stripping of the contracted thenar muscles or abductor action should be done at the same time. It is also recommended for some cases of postpoliomyelitis hand involvement and in some cases of Erb's brachial birth palsy. In the latter two conditions other operations, such as wrist fusion are usually indicated also.

VERNON C. TURNER, M.D.

**A Technique for Arthroplasty of the Elbow Joint.**  
A. CAMERON ARMSTRONG. *Med J Australia*, 1947 3 7 6.

The author describes the technique employed in operations on a young soldier whose elbows were ankylosed as a result of war wounds.

The head and neck of the radius are removed the anterior and posterior surfaces of the articular portion of the humerus are removed by osteotomy in such a way as to leave them flush with the flat surface of the humerus just above the fossae. The concave articular surface of the ulna is enlarged with a bone gouge, care being taken to preserve the insertions of triceps and brachialis tendons, three or four small drill holes are made through the lower end of the humerus in a horizontal line, about one inch from the end. The sac of a moderate sized hydrocele is drawn over the lower end of the humerus like a cap, with its peritoneal surface outermost. It is then firmly sutured into place with chromicized gut suture.

cumstances the impact is innocuous. However when the natural forces such as winds and terrain are adverse the jumper may experience an intolerable dissipation of the stress and a variety of injuries may be sustained. Such injuries may involve the crushing or torsion of the metatarsal bones or the driving of the talus into the mortise posteriorly fracture of the posterior tibial margin rupture of the tibiofibular ligament or spiral fracture of the tibial and fibular shafts.

**External rotation injuries.** Two-thirds of all fractured ankles in the present studies were found in the distal end of the fibula the fractures were oblique in nature and were acquired by external rotation of the limb. The mechanism of this injury is similar to that postulated by Ashhurst and Bromer. Since the lesion is produced by external rotation the treatment consists of slight internal rotation until healing is assured. Widening of the mortise is a well known sequel during the period of convalescence. To avert diastasis in this type of fracture the writers recommend vigilance plus extension of immobilization to the upper end of the thigh. Other external torsion injuries include the medial malleolus ligaments namely the deltoid and the inferior tibiofibular ligament. The latter when traumatized invariably jeopardizes the integrity of the ankle mortise and should be recognized and treated. Spiral fractures of the tibia and fibula at different levels are symbolic of external rotation injuries. The former occur at the juncture of the middle and lower thirds of the tibia and the latter at the upper third of the fibula. Meniscal and ligamentous injuries of the knee joint are also commonly observed. However as a rule derangement of the knee joint is of the abduction type of injury.

**Landing-thrust injuries.** These are usually associated with dorsal dislocation of the big toe fractured sesamoid impaction of the metatarsals, crushing of the metatarsal bones and soft tissue injuries.

In the event that the metatarsal bones are spared the posterior tibial margin may not escape fracture. Solitary fracture of this bone was originally described in 1909 by Meussner rediscovered by Cotton in 1915 and again rechristened during the last war as the paratrooper fracture.

**Injuries of external rotation plus landing thrust.** The usual pattern involved is one of fractured lateral malleolus and posterior margin and bimalleolar fracture with fracture of the posterior tibial margin which may be complicated by posterior dislocation of the foot and postreduction arthritic manifestations. The disability must be dealt with in such a way as to preserve the mortise. Open reduction of the posterior tip with internal fixation of the medial malleolar fracture is often mandatory.

**Adduction and internal rotation** produces 'sprained ankle' which may include disruption of the fibulocalcaneal ligament or avulsion fracture of the fibula. It may also produce fracture of the fibula at the level of the ankle joint and vertical split of the tibial malleolus.

**Backward landing.** Vertebral fractures and cranio-cerebral injuries characterize this mechanism of injury. Most fractures involving the vertebrae are of the compression type. The thoracolumbar region is the site of predilection. Anterior collapse of the involved vertebrae is the usual pattern. Violent hyperflexion of the spine when the paratrooper strikes the ground on his buttocks is responsible for the bony disintegration. Equally devastating is the soft tissue injury incurred upon the tendinomuscular apparatus of the spine i.e. low back sprains herniated intervertebral discs contusions of the coccyx, and traumatic myositis. The authors assert that there were 10 soft tissue injuries to one compression fracture of the spine. In their experience the trivial spinal injuries caused more notoriously disqualifying sequelae than the frank compression fractures.

**Opening shock.** Injuries acquired by this means occur in the midair or prior to ground contact on the part of the jumper. They are of two general types.

1 Whiplike in which the jumper is out of line with the tug of the opening parachute flipping him upside down. Sprained neck, transient neuropathies of the brachial plexus and ecchymotic brush burns may result.

2 In suspension line injuries extremities may become entangled with suspension lines prior to the unfurling of the parachute. Sudden arrest of gravitational descent exacts a toll of 40 per cent fractured femurs and more than  $\frac{1}{4}$  of all fractured humeri in midair. More common is the tear of the medial collateral and cruciate ligaments of the knee. Dislocation of the shoulders (10 cases) diastasis of the pubic symphysis (3 cases) and laceration of the perineum including the rectum, are some of the remaining bizarre occupational complexities of a paratrooper.

SAMUEL L. GOVERNALE, M.D.

**Slipped Femoral Epiphysis.** ARMIN KLEIN, ROBERT J. JOPLIN and JOHN A. REIDY. *J Am Med Ass* 1948 136 445

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The second group of animals were subjected to a similar fracture but it was immediately converted to a compound fracture and exposed to the air

In the third group in addition to subjecting the animal to simple and compound fractures the ends of the bones were severely traumatized by 10 blows.

All specimens were decalcified and studied. The picture presented was comparable to that previously reported by Ham and others i.e. numerous lacunae which normally house the mature adult bone cell were found to be devoid of cellular content. Further more the lining of the haversian canals had undergone marked destruction of endosteum and the capillary network. Evidence was obvious that trauma involved not only death of the bone cell, but a vascular catastrophe as well. When the microscopic slide was moved away from the cortex general cellular necrosis of the cortical bone was found up to the medullary canal. The first evidence of living tissue was observed in the haversian canals near the marrow cavity. Cellular death was not conspicuous in the medullary portion near or at the site of fracture. On the other hand a preponderance of cellular disruption was noted on the cortex at the same level of

the medullary cavity which failed to show cell death. Hence medullary bone is less vulnerable than cortical bone

The experimental simple fracture showed the least cortical devitalization. Conversely, those animals whose fractures were compounded manifested a wider zone of cortical devitalization than those with simple fractures. In the third group of dogs in which the ends of the bone were severely traumatized, a greater destruction of bones was observed than in the former groups.

Obviously the inference of the author's experimental data clearly indicates that severely traumatized ends of bones share equally in the devitalization and should be removed before internal fixation is completed. The removal of this nonviable tissue enhances the normal physiology of bone repair union.

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An extensive study on parachute injuries was conducted at the Airborne School at Ft Benning, Georgia. The report assumes definitive entities relative to mechanism, and anatomical/morphologic aspects of parachute injuries encountered among 3,000 major accidents which were categorically assessed and treated in a fracture center. Some of the major injuries were fractures dislocations, sprains, contusions, and numerous lesser soft tissue lesions sustained either in midair or when parachutes struck the ground (landing thrust).

Ninety per cent of the injuries involved the eight bearing organs of locomotion, being fractures of the foot ankle, leg, femur and spine, respectively. The traumatic hazards show a demonstrable predilection for the lower extremity. Eighty per cent or 2,337 of the soldiers sustained fractures from the tip of toes to and including the patella. The ankle per se, absorbs 50 per cent of the total number of cases. This is obvious as the men are instructed to land on their feet first. According to the momentum, air current oscillations, and uneven terrain, the parachutist absorbs the majority of the effects of the landing thrust on his ankles.

Cerebral concussions were noted in 110 patients in the present studies. These were due to a backward fall and occurred despite the adequate head protection worn by soldiers.

The authors list and discuss 4 traumatic etiological mechanisms which by and large affect the most vulnerable parts of the parachute jumper: they are (1) torsion plus landing thrust, (2) backward landing, (3) opening shock, and (4) vertical fall.

**Torsion plus landing thrust.** The parachutist descends with a downward and forward momentum, both gravity and wind drift governing the vertical and horizontal components. At the time he strikes the ground he meets an upward and backward reactive thrust or landing thrust. Under ideal cir

circumstances, the impact is innocuous. However when the natural forces such as winds and terrain are adverse the jumper may experience an intolerable dissipation of the stress and a variety of injuries may be sustained. Such injuries may involve the crushing or torsion of the metatarsal bones or the driving of the talus into the mortise posteriorly fracture of the posterior tibial margin rupture of the tibiofibular ligament or spiral fracture of the tibial and fibular shafts.

**External rotation injuries** Two-thirds of all fractured ankles in the present studies were found in the distal end of the fibula the fractures were oblique in nature and were acquired by external rotation of the limb. The mechanism of this injury is similar to that postulated by Ashhurst and Bromer. Since the lesion is produced by external rotation the treatment consists of slight internal rotation until healing is assured. Widening of the mortise is a well known sequel during the period of convalescence. To avert diastasis in this type of fracture the writers recommend vigilance plus extension of immobilization to the upper end of the thigh. Other external torsion injuries include the medial malleolus ligaments namely the deltoid and the inferior tibiofibular ligament. The latter when traumatized invariably jeopardizes the integrity of the ankle mortise and should be recognized and treated. Spiral fractures of the tibia and fibula at different levels are symbolic of external rotation injuries. The former occur at the juncture of the middle and lower thirds of the tibia and the latter at the upper third of the fibula. Meniscal and ligamentous injuries of the knee joint are also commonly observed. However as a rule derangement of the knee joint is of the abduction type of injury.

**Landing-thrust injuries** These are usually associated with dorsal dislocation of the big toe fractured sesamoid impaction of the metatarsals, crushing of the metatarsal bones and soft tissue injuries.

In the event that the metatarsal bones are spared the posterior tibial margin may not escape fracture. Solitary fracture of this bone was originally described in 1909 by Meissner rediscovered by Cotton in 1915 and again rechristened during the last war as the paratrooper fracture.

**Injuries of external rotation plus landing thrust** The usual pattern involved is one of fractured lateral malleolus and posterior margin and bimalleolar fracture with fracture of the posterior tibial margin which may be complicated by posterior dislocation of the foot and postreduction arthritic manifestations. The disability must be dealt with in such a way as to preserve the mortise. Open reduction of the posterior tip with internal fixation of the medial malleolar fracture is often mandatory.

**Adduction and internal rotation** produces sprained ankle which may include disruption of the fibulocalcaneal ligament or avulsion fracture of the fibula. It may also produce fracture of the fibula at the level of the ankle joint and vertical split of the tibial malleolus.

**Backward landing** Vertebral fractures and cranio-cerebral injuries characterize this mechanism of injury. Most fractures involving the vertebrae are of the compression type. The thoracolumbar region is the site of predilection. Anterior collapse of the involved vertebrae is the usual pattern. Violent hyperflexion of the spine when the paratrooper strikes the ground on his buttocks is responsible for the bony disintegration. Equally devastating is the soft tissue injury incurred upon the tendinomuscular apparatus of the spine, i.e., low back sprains herniated intervertebral discs contusions of the coccyx and traumatic myositis. The authors assert that there were no soft tissue injuries to one compression fracture of the spine. In their experience the trivial spinal injuries caused more notoriously disqualifying sequelae than the frank compression fractures.

**Opening shock** Injuries acquired by this means occur in the midair or prior to ground contact on the part of the jumper. They are of two general types: 1. Whiplike in which the jumper is out of line with the tug of the opening parachute flapping him upside down. Sprained neck, transient neuropathies of the brachial plexus, and ecchymotic brush burns may result.

2. In suspension line injuries extremities may become entangled with suspension lines prior to the unfurling of the parachute. Sudden arrest of gravitational descent exacts a toll of 40 per cent fractured femurs and more than 1/4 of all fractured humeri in midair. More common is the tear of the medial collateral and cruciate ligaments of the knee. Dislocation of the shoulders (10 cases) diastasis of the pubic symphysis (3 cases) and laceration of the perineum including the rectum are some of the remaining bizarre occupational complexities of a paratrooper.

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or more the alip is considered to be pronounced and to require open reduction. If it is less than 1 cm. it is considered minimal and no reposition is required but the hip is nailed *in situ*.

Open reduction is accomplished by means of the Smith Petersen intrapelvic approach and the epiphysis is separated from the femoral neck at the epiphyseal plate with a curved osteotome. Once separated the osteotome is left in place to serve as a *skid* and the reduction is done by traction on the leg in flexion internal rotation and finally abduction and extension of the femur. A separate lateral incision is made for the nailing. Follow-up care consisted of balanced traction for from 10 to 12 days. Two weeks after operation the patients were gotten up on crutches. Postoperative plaster spicas were discarded because there was a distinct tendency toward stiffened hips. Nonweight bearing walking caliper hip splints used with high sole on the good side have also been discarded because of the belief that such a brace threw across strain on the good hip. The built up shoe puts across strain on the good hip and the possibility of a slip of the contralateral hip must always be kept in mind. The use of crutches alone was therefore advised for the first 3 months.

The author presents a report of his survey of 31 slipped capital femoral epiphyses of which 42 were treated with the three flanged nail. 16 of these required arthrotomy. Reduction prior to nailing 3 cases were of the cut type.

There were no signs of aseptic necrosis and in only 3 cases were there a minimum of traumatic arthritis. These cases were among those in which open reduction was required and the condition in 1 case may have been caused by incomplete reduction. An average of 60 per cent of normal hip function was obtained when the hips were nailed *in situ* and 92 per cent of normal function was obtained when open reduction was required. These figures are based on observation periods of about 3 years. The results are the best so far reported. *VERMONT COLLEGE MED.*

**Indications and Results of Surgical Treatment of Monocondylar Fracture of the Femur and Tibial Plateau (Indicazioni e risultati nella cura chirurgica delle fratture monocondilare del femore del piatto tibiale)** LEONARDO GUI *Chir. org. merita* 947 3 308.

The author states that in fractures involving the knee joint (encountered most frequently during the third and fourth decades of life) there is danger of arthritis if perfect reduction is not obtained.

Fractures of the knee joint, of recent occurrence may be divided into three groups: (1) linear fractures without displacement, (2) fractures with complete separation of the broken fragment and (3) compression fractures. Fracture of one condyle is observed more frequently than of both condyles of the femur. The lateral condyle is fractured twice as frequently as the medial condyle and the lateral half of the tibial plateau breaks approximately five times as frequently as does the medial half.

The introduction of vitallium which is better than other materials, and the use of plaster which minimizes the danger of infection, are held to be great advances in treatment, but the author is convinced that surgical treatment does not decrease the period of functional disability. On the other hand manually closed reduction has, as a rule, effect on the fractures in question because of the small size of the fragment. The reduction is more difficult if the fracture is associated with laceration of the collateral ligaments or of the capsule. In fractures of one of the femoral condyles it is nearly impossible to correct the rotation of the fragment along the transverse axis.

If open reduction is required, the operation is delayed for a few days, to minimize the danger of infection. Operation is done under ether anesthesia with or without the intra-venous injection of morphine.

A longitudinal parapatellar incision slightly above its lower portion on the medial or lateral side is used for the reduction of a fracture of a condyle. It is advisable to refrain from incision of the patellar tendon at the tibial tuberosity.

The author cautions against the employment of a horizontal or an oblique incision for arthrotomy because of the possibility of injury to the collateral ligaments and the median portion of the outer branch of the saphenous nerve with the reformation of a neuroma or a zone of aneurysm. 1 or three nails of nonoxidizable material are insufficient to immobilize the fragment.

A fracture of the tibial plateau is much more difficult to reduce, especially if the posterior part of the tibial epiphysis is injured. The same procedure is recommended as for the open reduction of fracture of a femoral condyle. In patients with a posterior marginal fracture the incision is made on the anterior aspect of the articulation, in the medial-lateral region according to the site of the fracture. A wide exposure with due attention to the collateral ligaments is advocated. Five to 10 cm. sutures in diameter are employed. Complete hemostasis is essential. A rubber drain is inserted into the end of the wound. The extremity is immobilized with the knee flexed 30 to 35 degrees. Extension is maintained for a period of 2 to 3 weeks to allow the wound to heal and to reduce infection which is enhanced by early motion.

In conclusion the author states that if the patient does not show signs of a grave condition of the patient is good, gives the best results. *JOSEPH K.*

## ORTHOPEDICS IN GE

**A Study of Vascularization of the Importance in Traumatology (La circolazione del radio nella traumatologia)** ROMANO T *merita* 11 362.

The importance of blood vessel because of.

processes following various osseous lesions such as acute and chronic osteomyelitis and their function in the regeneration of bone following fractures.

The author has studied the distribution of blood vessels within the radius of cadavers. A 2 per cent gelatin solution with the addition of either Prussian blue or Congo red was employed for the injection of the brachial artery after preliminary ligation of the radial and ulnar arteries at the wrist. The radius was exarticulated placed in a 5 per cent formalin solution for 50 hours, rinsed in water and immersed into a 6 per cent nitric acid solution (for the purpose of decalcification) in which it remained from 25 to 34 days according to the age of the patient. Sections in frontal and sagittal direction were made and placed in pure glycerin for a period of 30 hours to make them translucent.

The entire material was divided into three groups according to the age of the patients i.e. 6 to 25, 26 to 40 and 41 to 72 years.

Inspection of the specimens demonstrated a relatively poor vascularization of the middle third of the bone as compared with the upper and lower thirds.

The difference becomes more marked with advancing age. According to Leriche, the circulatory factors are of greatest importance in the genesis of the osseous substance. Vascular deficiency impairs the active hyperemia which favors pathologic ossification. Poor blood supply is responsible for an unsatisfactory regeneration of bone tissue in the femoral neck and in the vertebral bodies.

The relatively poor blood supply of the radial diaphysis is responsible for retarded consolidation after fracture or a tendency to the formation of a pseudarthrosis. Inasmuch as it is impossible to augment the number of blood vessels the author believes that an effort should be made to increase the blood supply by producing hyperemia by means of the application of heat, Bier's passive congestion or Beck's operation.

JOSEPH K. NARAY, M.D.

#### Reconstruction of Opposition Digits for Mutilated Hands. B. K. RAWK and A. R. WAKEMIELD *Austral. N. Zealand J. Surg.* 1948, 17, 172

During a period of 4½ years in an Army plastic surgery unit while 630 patients with face injuries were treated 403 patients with hand injuries were also treated. In 55 per cent of the latter group gross mutilations had occurred. The 'pinch' or opposition function in a normal hand involves essentially the function of a normal thumb. For this to be effective in a mutilated hand three considerations must be met: (1) the thenar muscles must be present and active in a functioning state of integrity at attachment and innervation (2) there must be an adequate length of projecting thumb (3) there must be present an adequate length of finger or fingers to which the remaining length of thumb can become apposed in the movements of opposition and flexion.

The author advocates a four-stage operation as the most satisfactory means of obtaining an opposition digit.

*The raising of a tube pedicle (stage 1)* Under general or local anesthesia a standard tube pedicle is made in a convenient position on the abdomen or in the acromipectoral region.

*Attachment of the pedicle to the hand (stage 2)* Under general anesthesia the appropriate end of the tube pedicle is detached from the abdomen or chest. The tubing of a flap and its attachment to the stump at a single stage are not advised.

*Detachment of the pedicle from the abdomen (stage 3)* Usually only a small amount of local anesthetic solution is required for this stage. The pedicle is severed from the abdomen to leave the length required on the hand for the opposition digit. This stage, although it involves the simplest operation is the most important hurdle of the whole procedure.

*The bone graft (stage 4)* Under general anesthesia the longitudinal suture line of the pedicle extension is reopened about one-half to one inch short of the distal end and if necessary the incision is extended on to the normal tissues of the hand. By turning aside the pedicle extension the bone stump is exposed through the wound. This is trimmed of sclerotic bone and its medulla is gouged out with a small spoon to about half an inch. Cancellous bone from the iliac crest is used as the bone graft. One end is fashioned as a peg to be dowelled into the stump of metacarpal or phalanx the other end is rounded. It is approximately rectangular in section with corners rounded. The graft is arranged in the core of the pedicle and pegged into the open bone stump with as little disturbance as possible. The digit is splinted in correct position by a complete plaster which is left undisturbed for about a month.

*After care* After 1 month the plaster is taken off and sutures are removed. Daily and slowly increasing active exercises are commenced but between times a protection splint is worn.

*Reconstruction of paired opposition digits* Hands devoid of all fingers can still be rendered useful so long as some actively mobile thumb metacarpal bone remains. One mobile digit on the thumb base and one fixed digital extension from the palm can be made on the principle already described.

A slow distal extension of sensory appreciation in the grafted skin area is noted from month to month. The results show that any degree of hand function or movement which can be effected is much better than an amputation stump and superior to an artificial hand.

C. FRED GOEBELER, M.D.

#### The Synovial Membrane of the Knee. Clinical and Experimental Study (Le membrane synoviale du genou. Étude clinique et expérimentale) R. SOZUA *Rev. belge path.* 1947 18 Supp. 1

The author does not attempt a solution of the many controversial problems of the pathology of the synovial membrane of the knee but aims merely to add to the scant clinical and experimental knowledge of this organ. The literature is carefully reviewed and followed by a description of the author's own observations and experiments. For the study

of the normal histologic structure of the organ specimens were taken from stillborn infants young infants dying of pneumonia and cholera and from amputations in patients of various ages. No cases were included in which the bone or cartilage was affected.

The pathology of the soft tissues of the knee is discussed under four headings: namely rupture of the meniscus, hemarthrosis, chronic villous hypertrophic arthritis and Hoffer's disease. The latter, classically described as a primary transformation of the subarticular fat pad, is not considered as an entity by the writer but merely as representing the symptoms of ruptured meniscus, villous arthritis or some other disease such as chondromatous or tumor.

An attempt was made to reproduce these lesions in animals in order to ascertain the modes of reaction of the synovial membrane and the laws governing its reaction to given stimuli.

The normal synovial membrane was found to have two layers, one fusing with the other without any definite dividing line. The intima was largely unicellular with a few scattered histocytes. The external layer at the level of the anterior fat pad was composed chiefly of fat cells and was occasionally invaded by collagenic fibrils. This fibrous layer always excreted and there was no inflammatory element. It was looked upon as a sign of aging. Opposing theories are reviewed. Studies on the rabbit revealed that the histologic structure of the synovial membrane in this animal was identical with that in man.

With a view toward supplementing the previously reported histologic studies on meniscal lesions, 28 biopsy specimens were taken from a series of 106 cases of surgically verified lesions of the fibrocartilage. Three stages of the pathological process are described:

1. A preliminary stage with no demonstrable changes in the synovial membrane. By the second month anatomical reaction is stable and lasts as long as the lesion of the fibrocartilage persists (for 34 years in one case).

2. The second or florid stage is about 6 months, and is characterized by intense cellular activity and progressive fibrosis, but no inflammatory reaction.

3. The third or residual stage is until the meniscal rupture is treated by either partial or total removal of the organ, and presents symptoms similar to those of the florid stage but of a more chronic type. The signs of synovial activity subside but the fibrosis becomes organized and collagenic tracts tend to become systematized. There is also a varying degree of plasmocyte infiltration, occasional mononuclear and in rare instances, with nodular forms. Both in man and in animals the changes in the synovial membrane following rupture of the meniscus indicate a distant reaction. Apparently the synovial membrane is particularly sensitive to intra-articular disturbances.

The florid and residual stages of synovial membrane reaction to hemarthrosis in man and animals are likewise described. The effusion of blood into a joint has only a transitory and very superficial effect on the synovial membrane, leaving no lasting trace.

The identical histologic aspects of the synovial membrane in hypertrophic villous chronic arthritis in man and in animals indicate an identical mechanism a reaction comparable to the Arthus phenomenon occurring in the joint. In the florid stage the dominating process is a waxy degeneration of the basophilic substance with massive infiltration of plasmocytes and leucocytes. Together with the fibrocytes, these cells form the characteristic Klinger nodules. There are also signs of connective tissue activity, replacement of fatty tissue by fibrous tissue and increased vascularization.

The changes in the synovial membrane produced experimentally in rabbits by repeated injections of protein are similar to those observed in man, and suggest that the Arthus phenomenon leaves a residual cicatricial condition which is a long time and perhaps never fully revives the symptoms.

Intra-articular sepsis is therefore the most commonly encountered reaction and is found in normal joints in the florid stage of meniscal rupture in hemarthrosis in large arthritis and following artificial injection of homopurine into the joint of a non-sensitized animal.

The intra-articular irritants we cannot therefore be regarded merely as a filler but represents an active organ, extremely sensitive to the slightest mechanical, chemical or irritant stimulus. This latent function of the synovial membrane constitutes an abnormal response to stimuli acting under special conditions similar to that obtained in connective tissue under the same conditions.

Fibrosis of the synovial membrane per se yields no pathological lesion but the degree plus the presence of inflammatory helps to differentiate one pathological condition from another especially during the florid stage.

In mechanical and chemical reactions, the collagenous reaction is progressive and highly systematized. There is no infiltration.

In response to an infection the fibrous formation is very moderate but polymorphonuclear and mononuclear cells appear while histocytes collaborate to eliminate substances scattered through the joint.

If proliferation of connective tissue is marked during the course of the Arthus phenomenon, it is accompanied by plaque formation, degeneration and absorption by macrophages of the tissue by either diffuse or in

infiltration somewhat similar to that seen following mechanical insults develops. Similar convergence phenomena have been observed in biology.

The reaction of the entire joint to a meniscal lesion, the facility of resorption of hemarthroses, the chronicity of chronic arthritis and the termination of initially different conditions in residual arthritis have all been observed clinically. By the more complicated but also more detailed and accurate methods of microscopic analysis these findings can be histologically confirmed. A tiny biopsy specimen suffices.

The terms synovial activity, fibrosis and infiltration are defined and a table is presented showing the clinical and experimental findings in the synovial membrane in the diseases mentioned. Figures showing sections from the synovial membrane of the normal knee and of operative specimens as well as photographs illustrating cases and a list of references are included. EDITH SCHACHNE MOORE.

## Anatomy of the Foot and Examination for Its Disorders. ROBERT J. JOPLIN. *Occurp M* 1947 4 314

The author presents a very comprehensive description of the anatomy of the foot—its bones, muscles, ligaments, blood supply and nerve supply.

A carefully taken history including important facts in the family and past history as well as an accurate and detailed investigation into the complaints for which advice is sought should precede inspection of the feet.

A systematic routine examination should be regularly carried out with the feet about 4 inches apart. No examination is complete without roentgenogram and laboratory studies. A record should be made of the following: (1) swelling, generalized or localized; (2) vascular conditions of the skin; (3) knock knee if present; record the distance between the internal malleoli with the femoral condyles touching; (4) how legs record the distance between the internal malleoli; crests of the tibia; and the internal malleoli with the feet together; not only rickets but Paget's disease, Charcot's knees and arthritis cause bowing; (5) torsion of the tibia; this should be looked for and when severe must be corrected; (6) hallux valgus usually associated with primus varus deformity; this is a painfully disabling condition which frequently

exists in an otherwise strong healthy worker; a painless useful foot may result from a relatively simple Keller type of operation but such a foot is not ideal for heavy work requiring long periods of standing; (7) calluses and hammer toe deformities; these though small in appearance sometimes cause excruciating pain resulting in great disability; (8) the relative position of the foot to the long axis of the leg, when standing, this must be such that strain is avoided; faulty stance must not be neglected; the amount of varus or valgus should be recorded and measures taken to correct either when severe.

If examination of the longitudinal arch reveals depression, a simple carefully fitted support may enable a person to maintain his ambulatory status. The position of the heads of the metatarsals must be observed to detect any possible abnormal relaxation or so-called splay foot. Examination of the toes should include a search for the presence of arthritic changes in the joints, calluses between the toes, bunion, bunionsettes and exostoses with overlying bursa. When looking for a short heel cord the examiner should be on the alert in order not to confuse this with a positive Homan sign. The plantar fascia should be palpated for tightness or relaxation and for tenderness to pressure, especially over its attachment to the os calcis where a spur and overlying bursa may form a so-called policeman's heel. A peculiar gait may disclose the presence of a neurologic lesion of the central nervous system.

Correct muscular balance between pronation and supination, neutral position of the foot. A weak pronated foot may be greatly aided by a laced Oxford or high shoe with a long stiff counter, stiff insole and a thin heel.

The presence of Morton's toe syndrome may be diagnosed by the characteristic history and observation of localized tenderness on palpation with the finger tip between the third and fourth toes. Relief may be obtained by an operation to remove the edematous nerve.

Rigid flat foot or peroneal spasm may first be treated conservatively which when successful gives a better result than operative correction. Failure of the conservative regimen is usually an indication for triple arthrodesis. ROBERT S. REICH, M.D.

# SURGERY OF THE BLOOD AND LYMPH SYSTEMS

## BLOOD VESSELS

**A Simplification of the Diagnosis of Varicose Veins.**  
CHARLES A. STEDDER and LOUIS H. PALMER. *Ann. Surg.* 1948, 127 362

The authors individually consider the performance interpretation and relative merit of (1) the Brodie-Trendelenberg test, (2) the comparative tourniquet test of Ochsner and Mahorner, (3) the Perthes test (4) the compression test, and (5) the Schwartz test. They believe that the last three of these tests have little to offer are unreliable, and reveal no information which cannot be obtained by more accurate methods.

In any case in which a retrograde flow of blood can be demonstrated by the augmented Brodie-Trendelenberg test (as described) irrespective of the status of the deep circulation not only will no harm be done by ligation but, actually the usual benefit to the varicose veins from this treatment should be expected, and even further improvement in the extremity should be obtained by lessening the load carried by the true collateral circulation. Simultaneous ligation of both the superficial and deep venous systems, routinely performed by many with no untoward results, supports this view.

The authors outline in some detail a simplified approach to the accurate diagnosis of varicose veins.

EDWARD H. CAMP, M.D.

**Arterial Injuries.** MORRIS K. SMITH. *Ann. Surg.* 1947, 125, 866.

The basis for this study consists of 114 wounds of major arteries seen in an evacuation hospital in the European theater of operations together with 4 primary cases in which the patients were operated on in a general hospital in the same theater. In the series there were 4 deaths. Two of the patients had had amputation for gas gangrene, one died with anuria, and the fourth died suddenly the day after operation.

In 43 of the 114 cases seen at the evacuation hospital the type of treatment was not stated. Ligation was performed in 58 cases of which 32 presented gangrene. In 8 cases suture of the lacerated artery was performed with 3 instances of gangrene. Non-suture anastomosis was performed 6 times and in 5 of the cases there was gangrene. The results were compared with reports from other evacuation hospitals and found to be similar.

The author concludes that suture of lateral wounds of the arteries should ordinarily be done, and end-to-end suture should be done in cases in which it is practicable. The use of glass and plastic tubes, or venous grafts to bridge gaps does not seem from the statistics available, to have improved the results yet a consideration of individual cases justifies further trial.

THEODORE B. MAMMILL, M.D.

**The Syndrome of Thrombotic Obliteration of the Aortic Bifurcation.** ROBERT LAMICK and ARTHUR MORREL. *Ann. Surg.* 1948, 27 93.

The authors describe a clinical condition associated with thrombotic obliteration of the terminal portion of the abdominal aorta, and having no relation to the dramatic occurrence of the well known saddle embolism. The thrombotic disease appears to be one of long course and is compatible for years, with a seemingly almost normal life.

Usually the disease occurs in young adults, mostly males, whose presenting symptoms may be one or another of the following: (1) in the male, inability to maintain a stable erection due to insufficient blood flow to the spongy processes, (2) extreme liability to fatigue of both lower limbs, (3) global atrophy of both lower limbs, (4) pallor of the feet and legs.

The clinical findings may be (1) lack of pulsations in vessels below the aortic bifurcation, (2) no oscillations in leg or thigh, but a slight thrill close to Poupart's ligament as determined by an oscillometer, (3) somewhat elevated blood pressure in the upper limb without any renal disturbance, (4) no trophic changes, but wounds of the lower extremity may heal sluggishly or not at all.

The diagnosis is made on the history and physical findings in selected cases the disease is diagnosed by means of aortography. Prognosis is poor as dry gangrene always occurs after a prolonged period. In most cases, the disease appears first in one iliac artery and progressively involves the terminal aorta and the opposite iliac artery extensive periarteritis is a common finding.

The method of treatment is lumbar ganglionectomy or terminal aortectomy with bilateral lumbar ganglionectomy (or both) and the authors present 4 cases to illustrate these methods. In young people whose disturbances are essentially functional without ischemic organic changes, the authors believe a terminal aortectomy with excision of involved iliac segments and bilateral lumbar ganglionectomy is the treatment of choice. In the older age group (patients over 40 years of age) with circulation bordering on ischemia, and with global atrophy an upper right lumbar ganglionectomy and a left lumbar ganglionectomy to include the first to fourth lumbar vertebrae, if possible, is the recommended procedure. The periarteritis renders resection of the aortic segment too hazardous as a rule. In the "poor cases," (patients close to 60 years of age) presenting an advanced stage of the disease, with frank ischemia or gangrene, the operation is performed in stages with right and left lumbar ganglionectomies, resection of the involved iliac arterial segments, if feasible, and amputations subsequently if necessary.

Surgical treatment is contraindicated in (1) patients seen very late in the course of the disease, (2) in the presence of extensive periarteritis which pre-

# SURGERY OF THE BLOOD AND LYMPH SYSTEM

cludes easy aortic resection (3) in patients with fragile extensively sclerotic aortas the ligation of which could not be trusted precluding aortic resection.

EDWARD H CAMP M D

## MISCELLANEOUS

Anticoagulants. C. C BURT *Edinburgh M J* 1947  
54 632

Anticoagulants were used as therapeutic agents in 61 patients. Heparin was administered either by intermittent intravenous injections or by continuous intravenous drip. A single intravenous injection of heparin acts immediately but the effect passes off rapidly and the clotting time usually returns to normal in about 3 hours. Hence when the intermittent intravenous method is used the clotting time may be normal for perhaps 12 of 24 hours whereas by continuous drip it is possible to maintain the clotting time at any desired level (usually from 12 to 15 minutes). A saline solution containing 10 mgm of the drug per 100 c.c. of solution was regulated to run at about 25 drops per minute. Heparin can be added to glucose plasma, or to whole blood without reaction.

Reports by Swedish workers on the results of treatment of thrombotic disease by the intermittent intravenous administration of heparin are comparable with those of Canadian and American workers using the continuous drip method so that, contrary to what one might expect the thrombotic process apparently does not spread to any significant extent during the short periods of normal clotting time which occur when the intermittent method is used.

Other workers have shown that the effects of heparin can be prolonged by combining it with a menstruum containing gelatin dextrose and glacial acetic acid, with or without vasoconstrictor substances. This mixture can be given deeply into the subcutaneous tissue. Single injections containing from 300 to 400 mgm. of heparin result in elevation of the clotting time for about 3 days. Occasionally there is swelling pain and tenderness at the site of injection.

The majority (44 of 61) of the author's patients were treated by the intermittent intravenous injection

method (3 daily doses). After an initial dose of from 50 to 150 mgm subsequent doses were regulated according to the response to heparin as measured by the clotting time. A rise to 15 minutes or over was regarded as an adequate response.

The continuous intravenous drip method was used in 8 patients, 7 of whom had operations on the blood vessels. Heparin administration was begun toward the close of the operation or shortly thereafter and continued for periods varying from 15 hours to 12 days. The constant drip was regulated to keep the clotting time to as near 12 minutes as possible.

Dicoumarin which is given by mouth is much simpler to administer than heparin but less easy to control because of the large individual variation in rate and response to it. In this series 300 mgm. were usually given on the first day followed by from 100 to 200 mgm on the second day. Thereafter the amount was determined by the effect shown on the prothrombin time. Dicoumarin alone was used in 11 patients of the present series and in conjunction with heparin in 6 others. In all cases an attempt was made to keep the prothrombin between 20 and 60 per cent normal. The time taken for the prothrombin time to rise to the required level varied between 40 hours and 7 days after beginning treatment. It returned to normal in from 1 to 7 days. Resistance to combined heparin and dicoumarin therapy was seldom encountered.

If bleeding occurs in a heparinized patient the administration of the drug should be stopped. The use of protamine sulfate which is a specific and immediate antagonist of heparin has been suggested. Blood should be given if necessary. In any case the effect of heparin passes off in 2 or 3 hours. Oozing from the wound and probably some intraperitoneal hemorrhage occurred following operation in one of the heparinized patients and a wound hematoma occurred in another. The prolonged action of dicoumarin makes hemorrhage in a dicoumarinized patient more difficult to control. There is no specific antidote with an immediate action, but Vitamin K in large doses (200 mgm) has a slow antagonistic action. If hemorrhage is severe repeated transfusions of fresh blood may be necessary.

ORVILLE F GRIMES, M.D



excessive local reaction with edema which spread to the larynx and induce respiratory obstruction.

Because of its better localization and greater effectiveness cavernous hemangiomas of the face, scalp and intraoral structures in adults are more satisfactorily treated by means of electrocoagulation than by sclerosing agents. The intensity of the coagulation should be checked by keeping a finger directly over the tip of the electrode and also by observing the surface of the tumor during electrocoagulation. If the color of the mucous membrane changes even slightly from red to gray coagulation should be stopped immediately. The margin of safety between effective electrocoagulation and that which will result in a slough is very narrow and can be determined only by experience.

During the coagulation the electrode should be kept as far as possible from Stensen's duct, the muscles of mastication, the motor nerves, and other important structures. It is especially important that ample clearance be given the branches of the facial nerve. Spasm of the facial muscles often will occur during intensive electrocoagulation even when the tip of the electrode is 1 cm. or more from a branch of the facial nerve. This may result from direct stimulation of the muscle or from transmission of the current to the nerve by the intervening tissues. Accidentally active contraction of the facial muscles is not necessarily an indication of impending injury to the seventh nerve.

Pleniform or racemose hemangiomas are more difficult to obliterate than simple cavernous angiomas because of the increased pressure within the component blood vessels resulting from the arteriovenous communications. When seen early in life interstitial radiation may control them but ligation of the afferent vessels frequently is also necessary. In adults, lesions of this type with only a slight impulse often can be shrunk by means of electrocoagulation while radiation or injection of sclerosing agents alone is not likely to be of benefit. If the lesion is not too extensive, excision may be feasible and at times is the most effective means of control. This frequently is the case also when the expansive force is pronounced.

In cases in which phleboliths in hemangiomas about the face cause discomfort removal of the offending calculi is indicated.

#### A Modification of the Waugh-Ruddick Test for Increased Coagulability of the Blood and Its Application to the Study of Postoperative Cases. SEYMOUR B. SILVERMAN *Blood* 1948 3 147

A modification of the Waugh-Ruddick test for increased coagulability of the blood is presented wherein recalcified plasma is used instead of whole blood. This technique gives a sharper endpoint, keeps the reaction volume constant, has a reaction time which is not too extended and still retains the advantages of the Waugh-Ruddick test.

This new technique was used to study the effect of operation on the coagulability of the blood and

tests were performed on 9 patients admitted to the Royal Victoria Hospital, Montreal, for operation. All operations were done under spinal anesthesia. Tests were done preoperatively and postoperatively. The results indicate that there is a definite increased coagulability of the blood which begins within 24 hours after operation and may last for a week or more. In all cases the coagulation time was normal at the end of 2 weeks.

Since thromboplastin initiates and determines the speed of coagulation, the decreased coagulation time after operation can be explained by increase in the amount of available thromboplastin obtained from either the platelets or the tissue juices. Since the postoperative thrombocytosis does not occur until the sixth or seventh day, the increased circulating thromboplastin is presumably derived from damaged tissue in the operative area.

ROBERT MAYO TREMBLY, M.D.

#### ANTISEPTIC SURGERY: TREATMENT OF WOUNDS AND INFECTIONS

Local Treatment of the Whole Thickness Burn Surface. HARVEY S. ALLEN *Surg Clin N America* 1948 28 125

It is neither possible nor logical to dissociate the problem of general care of the burned patient from care of the local burn wound. After the burn shock has been successfully combated it should be anticipated that the patient will exhibit a serious secondary anemia and that a nitrogen imbalance will occur. Beginning the third or fourth day after the injury, and every second day thereafter, the patient's blood should be checked to determine the hematocrit, hemoglobin and plasma protein levels. These few blood examinations are sufficient to indicate the patient's general condition provided there is an adequate urinary output. Any significant lowering of these blood values must be corrected to keep them at a high normal level. A daily diet high in vitamin content, and containing 2 to 3 gm. of protein per kilogram of body weight, must be given. On about the fourth day the patient with a severe whole thickness burn will exhibit a steadily progressive secondary anemia and loss of protein which must be corrected, otherwise wound healing is interfered with and weight loss becomes extreme. The patient's progress must be constantly anticipated, checked and treated until the wound is closed by grafting.

The objective in treating severe burns has been to obtain closure of the whole thickness skin loss within a period of 3 weeks following the burn. The dressing applied at the time of the initial local burn is not disturbed for 10 days unless there are definite signs of infection. On the tenth day the patient is taken to the dressing room where the entire wound is visualized and an accurate estimate of the degree of the burn is obtained. By this time the patient's general condition is well stabilized, the demarcation between incomplete and whole thickness skin loss is apparent and incomplete whole thickness burns are entirely



healed or will be in another 2 or 3 days. The extent of the area of whole thickness burns can be readily determined and if there is a defect larger than a silver dollar wound closure is proceeded with as soon as possible.

Several methods are available for the removal of full thickness burn slough. Usually the most suitable method is that of daily dressing at which time the loose portions of the slough may be cut away by the scalpel and the raw area covered by fine mesh gauze, fresh Dakin's solution and a pressure dressing. This method is time-consuming and painful to the patient.

The second method for the removal of burn slough is the application of pyruvic acid in situ to the patient. This method has proved to be efficient for rather circumscribed perforations. The 1 per cent pyruvic acid paste is applied on the tenth day and excised daily thereafter. Repeated dressings are necessary and the application immediately after the application of pyruvic acid is painful. The advantage of the second method is that of quick separation of the more superficial types of full thickness burns. With this method the areas are ready for grafting in 10 to 15 days following the burn.

The third method of treatment is that of surgical excision. At the present time this is the preferred method for serious burns. The burn is examined on the tenth day and the area of whole thickness destruction is noted. In cases in which the area is larger than 2 inches in diameter surgical excision is done in the operating room under a light general anesthetic. The whole thickness skin slough is surgically excised with bleeding tissue. Bleeding is not excessive if the surgeon takes care to attain the exact line of cleavage between the burn slough and the underlying tissues. All bleeding is controlled by ligature or pressure and at the completion of operation the wound is dressed with dry fine mesh gauze and occlusive pressure dressings. Following excision the patient is not disturbed for 3 to 4 days when the patient is returned to the operating room where the clean surface is covered with split thickness skin graft. This method is efficient in that the wound is treated a minimal number of times prior to grafting

and spares the patient much pain. This method is not useful on burns of the face or neck because of the normally rapid separation of slough.

Primary surgical excision has not seemed to be feasible because it is difficult to estimate correctly the depth of a burn on the initial inspection.

FRANK F. KUTNER, M.D.

## ANESTHESIA

Diaphragmatic Paralysis. W. H. CAGGLES and LUNA A. GIFFORD. *Anesthesiology* 1945, 9: 45.

Anesthesiologists are accustomed to thinking of diaphragmatic paralysis as full stage intercostal paralysis in deepening stages of anesthesia. Diaphragmatic paralysis in the presence of functioning intercostal muscles is recognized by the observation of depression of the upper abdomen on inspiration with slight elevation of the abdomen on expiration. This is the converse of the rocking boat respiration seen in profound intercostal paralysis.

The incidence of diaphragmatic paralysis was 1 in 1,000 in the series of 18,000 anesthetic cases reviewed by these authors.

Several examinations were presented to illustrate that diaphragmatic paralysis may precede intercostal paralysis in many instances.

Illustrative examples showed that:

1. The phenomenon can recur in the same patient on different occasions when different gaseous agents are used.

2. Diaphragmatic paralysis may occur in second plane or the third stage of anesthesia, or in deeper planes.

3. Diaphragmatic paralysis may persist as long as 11 days before recovery.

4. Paralysis could have its onset several hours after termination of the anesthesia.

5. Paralysis can occur when local anesthesia is used.

Diaphragmatic paralysis has been observed during the use of nitrous oxide, ether, cyclopropane, sodium pentothal, avertin and procaine. No etiology was suggested by analysis of the findings in the cases observed.

MAX KATZ, M.D.

# PHYSICO-CHEMICAL METHODS IN SURGERY

## ROENTGENOLOGY

Clinical and Roentgenologic Evaluation of Venography  
EDGAR C. BAKER. *Am. J. Roentg.*, 1947  
58: 603.

The author's technique is as follows. Diodrast is used as the contrast media. A tourniquet is applied only to facilitate venipuncture; it is then released except in the occasional case in which on previous examination only the internal saphenous vein was visualized with evidence of block. In these cases the tourniquet, left in place, may show a highly incompetent deep circulation but no evidence of block. Venipuncture is made with the use of a 25/26 gauge needle in any available vein below the ankle. Twenty cubic centimeters of dye is injected over a period of 3 minutes if the leg appears normal, if the vessels are suspected of being abnormal, the injection is prolonged. Three 14 by 17 inch films are used. Stereoscopic pairs are made on a single film and the area covered extends from the ankle to the lower pelvis. The first exposure is made after about 8 c.c. of dye have been injected (45 to 60 seconds) and the injection is continued slowly while the remaining films are exposed. The last exposure and completion of the injection approximately coincides.

Most of the dye enters the deep circulation fairly close to the ankle through deep communication veins. A smaller quantity spreads superficially to demonstrate the external veins about the knee. Usually, the greater saphenous is well visualized. Normal subjects, remaining motionless in the supine position, frequently show dye in the deep and superficial veins in from 5 to 20 minutes after the injection. Movement of the foot or leg however quickly empties these veins.

**Acute superficial block.** The dye enters the deep circulation promptly. Some of the dye passing into the superficial circulation stops abruptly at the site of a connecting vessel turning directly inward or backward to enter the deep circulation or to other parts of the superficial plexus. No superficial veins are demonstrated beyond this block. Occasionally a different pattern is observed: short straight non-tortuous and nondilated veins extend upward and fade out in the peripheral tissue. Recognition is difficult without repeated studies. Acute superficial block is frequently confused with chronic superficial and chronic deep block.

**Chronic superficial block.** The veins are dilated and tortuous; numerous large superficial veins are visualized but not opacified; the deep veins show some dilatation and tortuosity; upward passage in the deep veins is slow; small connecting veins extend inward toward the deeper circulation; the abrupt turning toward the deeper circulation as in the acute form is also seen.

**Acute deep block.** Acute superficial block is always present; the deep veins in the involved area are rarely visualized; occasionally a thrombosed vein is demonstrated either in the superficial or deep circulation.

**Chronic deep block.** There is partial or complete absence of the deep circulation; the internal saphenous is visualized completely and is dilated and tortuous; short lengths of communicating veins (usually large and tortuous) extend from the saphenous vein to fade out into the soft tissue; if the deep block is limited to the foreleg most of the dye will enter the deep system above the knee.

Thrombi may be demonstrated as a mass within the vein by partial obliteration of the vein for a variable distance which shows a ragged border along the side of the thrombus and by complete block.

The results have been satisfactory in from 88 to 90 per cent of the cases.

The author concludes from his analysis of these cases that all disease processes involving the leg veins originate in the superficial system since the superficial veins are frequently involved separately while disease of the deeper system is always accompanied by superficial involvement. Thus it is no longer necessary to assume the occurrence of damage to the intima of the deep vessels to account for the presence of thrombosis of the deep circulation. Post-operative thrombosis of the deep veins is due to trauma of the superficial vessels and the superimposed venostasis caused by prolonged bed rest.

ROBERT BURNS LEWIS, M.D.

The Possibilities and Limitations of the Roentgenologic Examination of the Soft Tissues (Possibilités et limites de l'examen radiologique des tissus mous)  
GOLROETTE J. MELOT. *Bruxelles méd.*  
1948 28: 67.

By means of roentgenologic technique it is possible to render visible the course of the blood vessels and nerves, to outline the muscular planes particularly for the purpose of localizing foreign bodies, to locate neoplasms with reference to the surrounding tissues and to demonstrate articular pathology before typical bone changes have developed.

The author made a study of the differing contrasts obtainable with media of absorptive capacity for the roentgen rays; this capacity somewhat approached that of normal or pathologic tissue but he considered the data so far obtained of too specialized a character for presentation at this time. He is content to present a few representative findings helpful in the diagnosis or treatment of medical and surgical conditions. Roentgenographs are demonstrated which show that sebaceous cysts of the skin and even benign tumors can be distinguished from malignant infiltrating new growths. In the work on the female breast inflammatory processes are differentiated from tumors and the difference between benign

tumors and malignant infiltration was readily recognized. The amount and dispersion of the infiltrating process was often shown to be much greater than was suspected clinically which provided indications for and delimited future operative procedures.

Disadvantages of the method are the frequent difficulties encountered in the interpretation of the roentgenograms obtained. Chronic inflammatory changes, especially in the breast, may render a certain diagnosis extremely difficult or impossible. Another factor producing disturbing shadows and distortions in the female breast tissues is the habit of implanting radium seeds for the treatment of benign tumors or even Reclus disease, these shadows and distortions very closely resembling the picture proffered by malignancy. These shadows may mask the presence of a tumor. Even the folds of skin in the senile breast may prove confusing.

However taking into account the disadvantages here enumerated, and while awaiting a sufficient study and practice to enable the roentgenologist to properly discount them the author still insists that roentgenologic examination of the mammary gland gives more reliable information than clinical examination. Roentgenologic examination is equal to dissection of the gland itself, and equivalent to a macroscopic examination of the dissected specimen. It is the interpretation of these findings which must be made with considerable prudence.

JOHN W. BRENNAN, M.D.

**Roentgenologic Aspect of Certain Lesions of Bones: Neurotrophic or Infections?** JOHN R. HODGSON, DAVID G. POOR, and H. HERMAN. *Journal of Radiology*, 1944, 50: 65

The term neurotrophic is used to describe changes in the soft tissue and bone presumed to be the result of disturbances in the nerve supply to that part. In the past, certain lesions of the bone especially in the feet, have been ascribed to "neurotrophic" disturbances. The purpose of the article was to investigate the validity of the assumption that these changes in bone were due to "neurotrophic" disturbance.

Sixty-one cases were reviewed. Of the 61 patients, only 15 were found to have diseases involving the nervous system. In the cases in which lesions of the nervous system were present there seemed to be no evidence indicating that the neurotrophic changes were the direct cause of lesions of the bone. The lesions of the bone were the result of chronic osteomyelitis secondary to infection of soft tissue contiguous to the bone.

The authors concluded that similar lesions of the bones of the feet may be produced by a wide variety of systemic and local diseases. The changes in the bones of the feet may be due to a type of osteomyelitis secondary to chronic infection of the soft tissue contiguous to the involved bone. Review of the 61 cases in which the roentgenograms of the feet presented evidence of "neurotrophic change" revealed that in every case there was infection of the contiguous soft tissue.

The authors believe that the assumption that these changes in the bones of the feet are due to neurotrophic disturbance is invalid.

**Pulmonary Disease in Workers Exposed to Beryllium Compounds: Its Roentgen Characteristics.** LUCIEN M. PASQUET. *Radiology*, 1944, 50: 3

Certain pulmonary changes occur in people who have been exposed to the dust of beryllium compounds. These changes, although similar in many respects to those observed in certain recognized disease entities, are thought to be of sufficient difference to warrant their separate classification. The roentgenographic appearance of pulmonary changes is usually delayed for an average period of 24 months. Dyspnea, cough, and weight loss are the most frequent symptoms. Cyanosis is sometimes observed, there is no involvement of the peripheral nodes, and no constant enlargement of the liver or spleen.

Four patients had complete laboratory work-ups. All had polycythemia and the blood alkaline phosphatase was elevated in 3 patients. Ventilatory function tests confirmed the respiratory disability and established the secondary nature of the polycythemia. Other tests, including that for tubercle bacilli were negative. Roentgen examination of the skeletal system revealed no abnormalities. Less than 100 per cent of the 30 patients were followed. Of these, 30 per cent had died, 30 per cent were unimproved, and 40 per cent were improved. The predominant pathological finding was a granulomatous reaction infiltrating or completely obliterating the interstitial tissue. These masses contained dense hyaline material and infiltrates of lymphocytes, plasma cells, and macrophages. Many multinucleated giant cells with or without inclusive bodies were present. The mediastinal nodes may show a similar reaction.

Radiographically the pulmonary process was well developed in all of the author's cases and consisted of widespread fine-to-punctate, and coarsely nodular infiltration which involved both lungs uniformly; the apices and costophrenic sulci were generally clear. These lesions were of two types: granular and nodular. The former are more prone to become confluent; the nodular lesions vary little in size on the single film and measure up to 5 mm. in diameter. They are less numerous but are symmetrical in location. The vascular markings are obscured, and there may be mediastinal widening and cardiac enlargement.

In some of the patients, the lesions progressed slowly while in others no change was apparent in a 2 to 3 year period. Rarely complete clearing occurs; the more common finding is clearing with fine nodular residues. Partial or complete clinical remissions have occurred with little roentgen change and well advanced pulmonary lesions may be demonstrated in workers without symptoms.

The nodular and confluent lesions are thought to be more serious. However, further study and a longer period of observation is required for any but a

guarded prognosis. Pneumoconiosis, Boeck's nodular chemical pneumonitis, tuberculosis, tuberculous bronchomycoses, cardiovascular disease, erythema nodosum must be differentiated. ROBERT BURTON LEWIS, M.D.

**Observations on Diffuse Pulmonary Lesions.**  
HENRY FELSOW and G W HEUBELIN *Am. J. Roentg.*, 1948 59 59.

The authors describe their clinical and roentgen findings with diffuse pulmonary lesions during the 3 years at Percy Jones General Hospital Bat Creek, Michigan by including specially selected from civilian practice. The difficulties in arriving at a proper diagnosis often have been impressed.

It was found that it is hazardous to express an opinion on the basis of a single roentgen study. Even multiple examinations made at certain intervals may not be absolutely diagnostic. A co-ordination of the roentgen findings with clinical studies is apt to lead to the best results. In some few instances postmortem examination may have to furnish the final proof.

The authors found the following classification of distinct aid in evaluating the various types of diffuse pulmonary lesions (the types most likely to cause pulmonary densities are in italics)

1 Cystic lesions (a) *congenital cystic disease* (b) pulmonary pneumatocele and (c) neurocutaneous syndromes (*tuberous sclerosis*)

2 Aspiration (a) hemorrhage (b) drowning, (c) *lipoid pneumonia* (d) changes secondary to achalasia or esophageal malignancy and (e) foreign bodies

3 Inhalation-pulmonary edema (a) acetylene (b) beryllium, (c) carbon tetrachloride, (d) kerosene (e) nitric acid and (f) phosgene B dust-pneumoconiosis (a) *anthracosis* (coal dust), (b) *bagassosis* (bagasse) (c) *barilosis* (baryta) (d) *byssinosis* (cotton lint) (e) *graphite* (carbon) (f) *siderosis* (iron) (g) *silicosis* (silica) including *chalcosis* (potter's disease) and *calcosis* (marble-cutter's disease) and (h) *silicatosis* (asbestosis) C lipiodol and D therapeutic.

4 Deposition (a) *xanthomatosis* and (b) *hemoidrosis*, mitral stenosis

5 Embolization (a) fat embolism (b) multiple infarcts (septic or aseptic) and (c) annular shadows due to bronchial artery occlusion.

6 Trauma (a) blast and (b) pulmonary collapse complicating fractures of the skull

7 Vascular (a) *chronic passive congestion* (b) *pulmonary edema* and (c) pulmonary congestive changes due to nephritis (nephritic butterfly)

8 Bronchial (a) *atelectasis* (b) *bronchiectasis* (c) *chronic bronchitis* and (d) bronchial changes with cystic disease of the pancreas.

9 Infectious (a) bacterial (a) *pyemia* (b) *bronchopneumonia* (c) *brucellosis* (d) *leishmaniasis* (e) *tuberculosis*, (f) *sypthilla*, (congenital) (g) *fusospirochetal* and (h) *glanders* B viral (a) atypical pneumonia *psittacosis* C, *mycoses* (a) *actinomycosis* (b) *aspergilliosis* (c) *blastomycosis* (d) *coccidioidomycosis* (e) *histoplasmosis* (f) *moniliasis* (g) *torulosis* and (h)

*toxoplasmosis* and D others (a) tropical *paragonimiasis*, *schistosomiasis* (b) pulmonary alveolar *adenomatosis*, and (c) *amebiasis*, *ascariasis*, and *echinococcosis*.

10 Allergic (a) tropical *eosinophilia* (b) *Loeffler's pneumonia* (c) *periarthritis nodosum* and (d) *disseminated lupus*

11 Fibrotic (a) acute diffuse interstitial fibrosis (b) *scleroderma* (c) *irradiation fibrosis* (d) *bronchiolitis obliterans* and (e) pulmonary changes in drug addiction.

12 Hemopoietic (a) *polycythemia vera* (b) *sickle cell anemia*, and (c) *leucemia*

13 Boeck's *sarcoid*

14 Malignancy (a) lymphogenous and hematogenous metastatic malignancy (1) *sarcoma* (2) *carcinoma* (b) lymphomatoid disorders (1) *Hodgkin's disease* (2) *lymphosarcoma*.

15 Calcific (a) hyperparathyroidism vitamin D poisoning (b) *mycoses aspergilliosis histoplasmosis* (c) *mitral stenosis* (d) *miliary tuberculosis* (e) metastatic osteogenic *sarcoma* with bone production and (f) *arteriosclerosis*

In interpreting the roentgenograms certain aspects are of more or less value from the point of view of differential diagnosis. These are (1) the size and number of lesions (2) the appearance, (3) the distribution (4) the progression and retrogression and (5) the presence or absence of an associated mediastinal enlargement and increased prominence of the hilar shadows.

Brief resumes are given of 18 interesting cases and their respective roentgenograms are presented to illustrate the point in question.

An extensive bibliography is appended

T LEUCUTIA, M.D

**Postbulbar Ulcer of the Duodenum.** ROBERT P BALL, ALLAN L. SEGAL, and ROSS GOLDEN *Am. J. Roentg.*, 1948, 59 90.

Duodenal ulcer located distal to the bulb is rather uncommon. Because of the high incidence of hemorrhage especially of the massive type which occurs in the condition it is important that diagnosis be made with accuracy. Unfortunately, the standard procedures do not always lead to the best results.

The authors review in detail the available literature. The incidence of postbulbar ulcer of the duodenum is undetermined. In routine autopsy material the condition is found in from 5 to 20 per cent of cases with duodenal ulcer. Surgical statistics indicate a somewhat higher incidence, whereas the roentgenologic reports for obvious reasons give much lower values.

Anatomically and roentgenologically the duodenum is divided into the pars superior the descending limb the pars inferior, and the ascending limb. The terms "first portion," "bulb," "cap," and "pars superior" are used synonymously although the bulb is a subdivision of the pars superior representing about five-eighths of its length. The distal extremity of the pars superior is the flexure of the genu

superius. Any ulcer located distal to the apex of the bulb is classified as a postbulbar ulcer. Since in the presence of inflammation it often becomes impossible to determine accurately the apex of the bulb, the cases reported are ulcer craters located in or distal to the genu superius (flexure), in the proximal portion of the descending limb of the duodenum.

The use of an exaggerated oblique projection with the patient in horizontal position or with the head lowered below the horizontal plane is necessary to demonstrate postbulbar ulcer roentgenologically. The anatomic variation of the pars superior and the amount of irritability incident to the ulcer determine the degree of rotation required in the positioning of the patient. According to Schons, the position must be so chosen as to yield the most satisfactory lengthening out of the upper duodenum. Spot films with controlled compression are of additional value.

The most important roentgen sign of postbulbar ulcer is a smooth rounded indentation of the wall of the duodenum at the level of the crater with an eccentric narrowing. Occasionally more than one indentation is noted opposite the crater. Enlarged, distorted mucosal folds, irritability of the bulb and hypermotility are associated findings. The authors observed no mechanical obstruction in their series.

The differential diagnosis includes duodenitis, diverticula and neoplasms of the duodenum. The various distinguishing features are discussed.

The article is illustrated with roentgenograms showing the anatomic variations of the normal duodenum and the characteristic signs in 6 cases of postbulbar ulcers.

T. LEUCOTIA, M.D.

**Hilar Densities Simulating Neoplasms.** CHARLES GOTTLEB and HERBERT S. SHARLEN. *Radiology* 94:5, 50: 57.

The roentgen appearance of hilar densities is rarely if ever specific for any one disease entity. Eight cases presenting bronchogenic carcinoma, pulmonary tuberculosis, atypical pneumonia, central pneumonia, eosinophilic pneumonia, lung abscess and pneumonia with delayed resolution are reported. Due to the similar roentgenographic appearance of all these lesions, the authors emphasize the importance of utilizing all possible diagnostic aids, such as bronchoscopy, laboratory procedures, history and serial radiograms before a final diagnosis is attempted.

ROBERT BURNS LEWIS, M.D.

**The Role of the Roentgenologist in the Diagnosis of Polypoid Disease of the Colon.** PAUL C. SWENSON and RUSSELL W. ORR. *Am. J. Roentgenol.* 94:5, 59: 63.

The authors evaluate the methods and techniques that can be used in the diagnosis of polypoid lesions of the colon. They also discuss the responsibility of the roentgenologist as a consultant to the internist or surgeon and as a clinician to the patient.

**Methods and criteria of diagnosis.** Obviously a proper preparation of the patient is necessary. The various methods of examination include the single

contrast study, the double contrast study (with stereoscopy) and the roentgenoscopically controlled compression study. The first roentgenologic clue to the presence of a polypoid lesion comes during the initial filling of the colon with the barium sulfate water suspension. An evanescent concave border is the advancing opaque column or a filling defect is seen. Spot pressure films bring out the defect posteriorly. If the tumor is pedunculated the point of origin of the pedicle may also be visualized. Since polypoid lesions often are multiple the entire extent of the colon must be carefully scrutinized. The patient is re-examined roentgenoscopically after the evacuation of the enema. Whenever the findings are inconclusive the double contrast study is used.

Puckering of the bowel wall at the site of attachment of the polypoid growth is pathognomonic.

**Responsibility to the surgeon or internist.** Formerly the authors were of the opinion that at least two examinations are necessary before surgery is advised. Now they think that a second examination is in order only when neither a pedicle nor bowel dimpling can be demonstrated. A visualization of the point of origin of the pedicle will greatly aid the surgeon in opening the bowel at the exact site.

**Responsibility to the patient.** In reporting the findings the term "polypoid lesion" is preferred to the term of "polyp" because the latter may give a false impression of benignancy. Neither the pedunculated nature of the tumor nor its size constitute criteria of possible histopathologic evaluation.

Patients with polypoid lesions should be restudied postoperatively at frequent intervals regardless of the histopathology of the surgical specimen. At least 30 per cent of the combined total of polypoid tumors of both rectum and colon are found beyond a sigmoidoscopic reach of 10 inches.

**Case reports.** Patients with polypoid disease seem to fall into four different clinical groups. Group 1: hemorrhage, negative sigmoidoscopic examination. Group 2: hemorrhage with a proved growth in the rectum or rectosigmoid, clinically group 3: hemorrhage or nonspecific complaints, no sigmoidoscopic studies, and group 4: complaint is consistent with ulcerative colitis. The authors present brief histories in typical cases of all these groups (1 case altogether) and use the respective roentgenograms for the illustration of the salient points. Four classes of polypoid disease of the colon are distinguished: (1) single lesion, (2) limited but multiple lesions, (3) true multiple polyps, and (4) polypoid manifestations in ulcerative colitis.

In conclusion the need for careful and repeated study of the colon is emphasized in cases of obscure bleeding.

T. LEUCOTIA, M.D.

**The Treatment of Breast Cancer by Radium and Roentgen Therapy (Le traitement du cancer du sein par C. radiothérapie et roentgenthérapie).** J. MARIN. *Acta radiol. Stockh.*, 94:7, 53: 593.

The author, Director of the Cancer Institute of Louvain, states that because of its surgical access-

lity and the possibility of radical surgery breast cancer has always been attacked by operative measures. These in his opinion leave much to be desired the eventual outcome. Therefore in a series of attempts he has attempted a special technique of irradiation therapy, and he compares the results of irradiation alone of irradiation with hormonal therapy and of preoperative surgical irradiation. The Steinthal classification was employed the first two groups being considered operable cases and the last two inoperable. These statistics have been carefully evaluated and studied objectively.

Biopsy was taken only after preliminary irradiation with from 500 to 750 roentgen units to the area of biopsy. If the tumor was small it was removed or biopsy with the electrosurgical cutting current. If it was large an aspiration biopsy was performed. If the biopsy was positive, the entire area which would have been removed by a surgical procedure was seeded with radium elements. In the area of the tumor the needles of radium were placed 1 cm. apart. In the axilla and in the more distant areas from the tumor the needles were placed from 2 to 3 cm. apart. The needles contained 1 mgr. of radium with 1½ cm. of radiating surface and ⅜ mm. of platinum filtration. A total of from 100 to 120 mgr. of radium were employed and left in place for from 5 to 7 days. This was followed either by 1,000 to 1,500 roentgen units of irradiation to the breast and a similar amount to the axilla and sometimes to the supraclavicular area or by similar irradiation with a 6 to 11 gr. radium bomb.

The considerable radiation dermatitis which followed was treated with penicillin and vitamin A ointment. The skin in most cases became soft and supple, but some cases presented the typical post radiation lesions.

Before 1931 290 operable patients had been treated in this manner. Of this group treated over 5 years, 116 (33.6%) were alive and well at the end of 5 years and of 125 who were followed up for 10 years 45 (36%) were alive at the end of 10 years. The inoperable patients who had supraclavicular metastases or distant metastases were usually given palliative treatment. No therapy was given to patients with liver metastasis. Sedative radiation was given for pain in small doses of from 25 to 50 roentgen units per sitting for total dosages of from 500 to 750 roentgen units. The 5 year survival rate in this series was only 4.5 per cent.

The author compares these series with one in which surgery and irradiation was used. The percentage of 5 year survivals was approximately the same as when irradiation alone was used. When hormone therapy was added in the form of castration there appeared to be no very great difference in the survival rate. In individual cases especially those with osteoclastic metastases or large ulceration certain surprisingly beneficial results were obtained from the use of subcutaneously implanted stilbestrol. The pain of osseous metastases seemed to be diminished in many instances by the use of testosterone

Statistical results of hormonal therapy were not included. The author also mentioned the beneficial results of irradiation in recurrences and metastases following radical mastectomy.

The author concludes by stating that irradiation therapy has certain advantages over surgical therapy not the least of which is the preservation of the skin. He believes that the radiation dermatitis which accompanies this mode of treatment is a minor inconvenience. This treatment however is not simple and requires rather large dosages of radium.

WILLIAM C. BECK, M.D.

**Carcinoma of the Cervix. A Discussion on the Value and Techniques of Supplementary X Ray Therapy** J. G. WINTERMITS. *Brit J Radiol* 1948 21: 27

The author discusses the value of combining radium and roentgen therapy in the treatment of carcinoma of the cervix. The procedure described is a modification and development of that which has been used at the Royal Cancer Hospital for some years. Roentgen therapy supplementary to radium is given with the object of delivering an effective dose to the lateral portions of the parametria and to the lateral wall of the pelvis. It is felt that the region close to the uterine cervix is adequately irradiated by the intracavitary radium. The irradiation is confined to rather narrow (15 by 4-6 cm.) fields lateral to the area which has received at least 6,600 roentgens from the radium application. It is directed toward 4 principal areas of lymph node metastasis including the internal iliac, the external iliac, the obturator and the parametrial lymph nodes.

The very ingenious apparatus used for the accurate localization of the cervix in the position in which the treatment is to be given is described with illustrations of the intravaginal and external components and the measuring devices that allow for the connection of the distortion. The pelvic tripod which is a simple but effective means of obtaining and maintaining accurate positioning in the prone position is described and illustrated. A very complete description of a device called the pelvic measuring bridge for estimation of the dose distribution to the critical areas is included. By the use of this instrument it is possible to reconstruct the treatment conditions in space and to accurately determine the depth doses by the use of isodose charts. The external fields that may be used are two anterior abdominal two sacral two gluteal and two sciatic fields. Compression is used if possible, to decrease the distance factors. At present irradiation is being given at 400 kilovolts. The author believes that when higher voltages are available the treatment will be simplified by allowing the administration of adequate dosages through fewer fields and that this would also even further increase the accuracy. Obese patients are not accepted for external therapy but with higher voltages this may become possible.

The method described is rather elaborate due to the numerous mechanical devices but in actual use

It has been found that the use of these devices makes for simplicity in setting up the patients, the accuracy of aim is increased, it is possible to restrict the size of the fields to fix the conditions, in that they can be adequately reproduced at each treatment, and to give adequate data for accurate estimation of the dose distribution.

S. A. PATTERSON, M.D.

### RADIUM

**Dosage Estimation and Distribution in the Radium Treatment of Carcinoma of the Cervix Uteri.**  
M. LEDERMAN and L. F. LAMERTON. *Brit J Radiol.* 948

Radium dosage, although effective clinically, has always been empirical. The dosage is expressed in milligram hours or in millicuries destroyed. Methods had been devised in an effort to simplify the distribution of a given dose of radium; these however were so cumbersome that it was considered impracticable to consider the use of radium as a routine.

The authors present their method of estimating the dose of radium at any given point in the pelvis. The procedure may be used routinely and takes into account individual variations in anatomy.

A double exposure film of the pelvis is taken, with utilization of a tube shift from which the positions of the radium sources in the pelvis can be determined. A contour projector is used to determine the necessary dosage at any given point in the pelvis. From the clinical point of view it is possible, with this method, to estimate the dosage received by the diseased tissue and adjacent normal structures, to investigate the anatomical and technical factors affecting dose, and the correlation of radium and external radiation therapy.

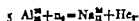
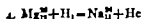
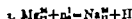
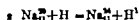
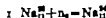
MAURICE D. SACHS, M.D.

### MISCELLANEOUS

**Radioactive Sodium as a Tool in Medical Research.**  
EUGENE H. QUINBY. *Am J Roentg* 947 35, 741

This is a condensed account of some uses of radioactive sodium 24 as a tool in medical research. The information is collected partly from the literature and partly from the author's personal experience.

Radioactive sodium can be produced by bombarding sodium with neutrons or deuterons, magnesium with neutrons or deuterons, or aluminum with neutrons, according to the five following formulas:



In every case the product is sodium having atomic weight 24 instead of 23, which disintegrates by the ejection of a beta ray, transforming the nucleus to magnesium and emitting gamma rays as the magnesium becomes stabilized. The half-life is 15 hours.

The radioactive sodium, whether originating from a cyclotron or the uranium pile, is usually delivered for use in the form of a solution of sodium chloride, which, however, contains only an extremely small fraction of the radioactive atoms.

In animal tissue the sodium is uniformly distributed throughout extracellular body fluids, freely passing back and forth across capillary membranes. When radioactive sodium is administered by mouth or intravenously a similar distribution occurs. Its presence can be detected by the Gieger-Moche counter.

One of the first applications of radioactive sodium concerned the determination of the volume of the extracellular fluid of the body. This work was carried out by Kallreiter and his associates at the University of Rochester by using radioactive sodium and thiocyanate simultaneously. The results obtained with sodium gave about 31 per cent of body weight as "sodium space" extracellular fluid, of which 15 per cent was plasma and 85 per cent, interstitial fluid. The thiocyanate results indicated a "thiocyanate space" representing 23.5 per cent of the body weight.

As a sequence of these investigations, Fox and Keston of Columbia University, New York, studied the mechanism of shock produced by burns and trauma. From previous clinical observations it appeared that in extensive burns a redistribution of sodium and potassium takes place and that the "antiosodium barrier" between extracellular and intracellular fluids might break down. By determining the "sodium space" with radioactive sodium, Fox and Keston found in experimental animals that the burned tissues (skin and muscle, which normally contain very little sodium) indeed take up a large proportion of the administered isotope. Such animals treated by intraperitoneal injection of normal saline solution equal to 16 per cent of their body weight recovered while similarly burned animals which were left untreated invariably died. Later, some very successful results were obtained also in human beings by the administration of large volumes of isotonic (sixth molar) sodium lactate solution by mouth or infusion.

A somewhat similar work was done by Greenberg and his associates at the University of California, San Francisco. These investigators studied with the aid of the radioactive sodium and other radiobiotopes the mode and rate of formation of the cerebrospinal fluid and especially the role of the barrier membranes in separating the blood plasma and cerebrospinal fluid. The conclusions were reached that the exchange between the blood and the brain takes place by a process of secretion and not by simple diffusion or ultrafiltration.

# PHYSICO-CHEMICAL METHODS IN SURGERY

The author herself studied *in extenso* the variation of the circulation time in peripheral vascular disease.

Sodium was injected into an antecubital vein with the window of the portable shielded Geiger counter against the sole of the foot, and the arm to the circulation time was measured. The work led to the development of a very valuable clinical test. It was found that it takes a certain time before an equilibrium of radiosodium concentration is built up between plasma and extracellular fluid and that the shape of the curve expressing the corresponding increase of the counting rate often can be correlated with the clinical condition of the vessels. Such radiosodium 'build up curves' have been found useful in diagnosis, prognosis and the selection of therapy in arteriosclerosis, hypertension, thromboangitis obliterans, Raynaud's disease, various thrombi, emboli, trench and immersion foot, and frostbite.

Other problems that have been studied by the author and her associates with the aid of radioactive sodium as tracer include testing of the value of various drugs and physical therapy procedures in the treatment of peripheral vascular disease, testing of the efficiency of various tourniquets to cut off circulation, investigation of mechanical methods of artificial respiration to determine whether blood could be made to circulate by a respirator if coagulation had not occurred, and more recently determination of the most efficient method for the administration of penicillin by means of a nebulizer in certain pulmonary conditions.

In concluding the author emphasizes that in all such experiments the amount of the radioactive tracers given must be small so as not to constitute a danger to the patient. On the basis of Marwell's formula, it is safe to use tracer doses of from 2 or 3 microcuries of radioactive sodium per kilogram of body weight and to repeat them a few times at reasonable intervals. This dosage, however, does not apply to any other radioactive isotope.

T. LEUCUTH, M.D.

Comparison of the Lethal Effect of Neutrons and Gamma Rays on Mouse Tumors by (a) Irradiation of Grafted Tumors in Vivo (b) Irradiation of Tumor Fragments in Vitro L. H. GRAY and JOHN READ *Brit J Radiol.*, 1948, 21 5

Carcinoma 2146 was inoculated into the thigh of a mixed strain of mice. When the tumor reached the size of 10 mm<sup>3</sup> the mice were irradiated with a neutron beam (2.8 MEV) or gamma rays (500 mgm radium plaque).

The lethal effect of both x irradiation and neutrons as determined experimentally on the broad bean root was due to chromosome and chromatin changes. The efficiency of neutrons in rendering tumor growth nonviable increases with decreasing neutron energy (slow neutrons).

The mean lethal dose in vivo and in vitro of neutrons and x irradiation (efficiency factor) was 24 and 9.5 times less respectively.

MAURICE D. SACHS, M.D.



## MISCELLANEOUS

### CLINICAL ENTITIES—GENERAL PHYSIOLOGICAL CONDITIONS

**Blood and Liver Proteins in Surgical Patients as Related to Protein Depletion** HARRY H. LEE, VEEN and WILLIAM H. FISHDAM. *Ann. Surg.* 1948, 17: 352.

The protein reservoir in the form of total circulating plasma proteins, although partially dependent upon the concentration of plasma proteins, cannot be assessed by isolated plasma protein value. The total circulating protein per square meter of surface area is lower in hypoproteinemic patients.

The precipitable saline soluble liver protein per unit of protein structural mass (ratio of precipitable saline soluble to saline insoluble protein) is maintained at a relatively constant level between 1 and 2 gm. per gram of structural protein. The constancy of this ratio suggests that there are definite protein storage limitations in the liver and also that a certain quantity of precipitable saline soluble protein is retained by the liver cell for preservation of vital functions. The variations between 1 and 2 gm. per unit of structural mass allows for a maximum possible storage capacity of 2.38 gm. of protein in a 1,500 gm. liver. That such storage actually occurs at least temporarily was illustrated by one patient receiving a large plasma and blood transfusion.

Since most ratios of precipitable saline soluble to saline insoluble liver protein are maintained closely in the region of 1.5 it is unlikely that ratios raised by plasma infusions remain high for more than a short time. Because this ratio is fairly constant there is a relatively large stationary protein mass in the liver. Such a situation tends to mask any small changes in protein concentration which may occur and may have led some investigators to believe that there is no relationship between the blood and liver proteins.

The fact that liver proteins participate in alterations occurring in plasma proteins is evident from the data presented. The rapidity with which changes may occur is demonstrable in experiments on dogs. The results of both studies are therefore in harmony.

JOHN J. MALONEY, M.D.

**Septicemia Due to the Proteus Vulgaris.** HERBERT L. ABRAHAM. *A. England J. M.* 1948, 238: 85.

*Proteus vulgaris* is usually considered nonpathogenic and is commonly found in normal feces, however it has been implicated in a large number of pathologic states and has produced septicemia in a few cases. Data on 52 cases of *Proteus* septicemia collected from the literature are summarized. Cases have been reported at all ages, although most of them occurred during the third decade. 44.7 per cent of the cases originated in the ear, nose, or throat and 46.8 per cent originated in the genitourinary

tract. The characteristic pathological finding was the foul-smelling green or brownish-green pus in all infected areas.

Most of the patients appeared acutely ill and as a septic fever with chills, although occasionally a typhoidal type of fever curve was encountered. Leucocytosis was usual and anemia was occasional. The illness was very long in the patients who recovered, although it was usually shorter in those subjected to some operative procedure. Most of the conditions arising from the ear presented a discharge and a history of chronic otitis. Fifteen of the 22 conditions arising from the genitourinary tract occurred after operative procedures. The mortality was 80.1 per cent in those arising from the ear, nose, and throat, 36.8 per cent in those arising from the genitourinary tract and 64.6 per cent for the whole series. The diagnosis was established by positive blood culture.

The author presents one case of *Proteus* septicemia with recurrent chills and fever following cystoscopy for renal calculi done 5 months before. Sulfonamides had brought a temporary remission of the fever and penicillin had had no effect. After positive blood cultures were obtained for the *Proteus vulgaris* the patient was given 0.3 gm. of streptomycin every 3 hours for 10 days, and recovery was prompt.

ROBERT MARIO THORNTON, M.D.

**Estrogens and Tumor Genesis.** BENJAMIN ZONDEK. *Adv. radiol. Stockholm*, 1947 13: 433.

The danger of the carcinogenic effect of estrogens in man has been highly exaggerated. During 20 years of clinical experience with estrogenic hormones the author has never observed the induction of a malignant tumor in man. Cancer can be reduced in some rodent strains of high cancer susceptibility when estrogens are administered in very large doses.

However, during the past decades large numbers of women have undergone estrogen treatment for many months and even years. If there were a carcinogenic effect, the number of cancers both of the uterus and breast would certainly have been greatly increased, which has not been the case.

The most that can be deduced from animal and human experience to date is that estrogenic hormones should be administered with greater caution to patients having cystic mastitis or cervical erosion or to those belonging to families with a high cancer incidence.

FRANK B. QUINN, M.D.

**Mesenchymoma, the Mixed Tumor of Mesenchymal Derivatives.** ARTHUR PUNNET STOUT. *Ann. Surg.* 1945, 7: 32.

Mesenchymomas are tumors made up of an amalgamation of mesenchymal elements capable of producing muscle, fat, blood vessels, cartilage or bone. The individual tumor consists of at least two of these elements and all of these tumors are actually

potentially malignant. They are usually found in ucle or subcutaneous tissues.

The author reports 8 cases and states that these ors may occur anywhere including the liver, s pleura and lateral part of the neck. He also ws attention to the fact that they do not neces arily occur in regions where congenital malforma ons are to be expected such as the urogenital ract and breast. In the latter locations these tumors contain epithelial elements as well as mesodermal rivatives such as adenofibromas of the breast and he adenocarcinomas of the kidney.

Treatment begins with biopsy to determine the ure of the neoplasm. Early and radical surgery recommended when the diagnosis is made even if means amputation. EDWARD R. DOMOGAY, M.D.

### EXPERIMENTAL SURGERY

**Experimental and Clinical Studies of Reduced Temperatures in Injury and Repair.** H. BAXTER, M. A. EDWIN and R. H. MORR. *Plast. Reconstr. Surg.* 1948, 3, 11

In a preceding paper the authors pointed out that the study of the behavior of wound healing and tissue regeneration under the influence of reduced temperature forms an important phase of the broad investigative project encompassing the experimental and clinical study of the effects of reduced temperatures on injury and repair of human tissues. Apart from the broader aspect of the pathogenesis of injury by cold considerable interest has been stirred up in the recent literature on the effect of local reduced temperatures in a variety of conditions including the treatment of burns. Before adequate appraisal of the effect of cold on the healing of burns in man could be undertaken, it was well to know what effect cooling has on the healing of clean surgical wounds particularly with regard to the rate of epithelialization and fibrous tissue formation.

Dermatome donor sites—areas from which a uniform layer of skin was removed with the Padgett Hood dermatome—were selected for the purpose of the experimental study. Fresh dermatome donor areas have several features which make them suitable for study of effect of cold on wound healing.

(1) Uniform thickness of split-skin can be removed from two or more comparable sites, which provides standard areas where spontaneous healing with tissue formation and epithelialization can occur.

(2) It is possible to vary the time required for spontaneous healing by removing thinner or thicker layers of skin.

(3) The behavior and rate of epithelialization have been extensively studied and a standard type of dressing giving optimal spontaneous healing is now used routinely in skin grafting which provides a condition in which alteration of the temperature of the environment is the only variable factor.

(4) In spite of the obvious difference of the two conditions dermatome donor areas are somewhat similar to moderate burns of the skin because in both

cases skin is destroyed to a certain depth and re-epithelialization of the area, apart from the proliferation from the edges of the wound takes place from the portion where the hair follicles sweat glands and ducts remain intact.

Donor areas on the anterolateral aspects of the thighs in the healthy adult were selected for this experimental study. The cooling was obtained by placing the entire limb into a special apparatus constructed for that purpose. The apparatus had two chambers in one of which cold air circulated in a closed circuit while in the other air at room temperature was similarly kept in motion for the control limb. The alterations of the state of the vascular system of the areas under observation were determined by recording the skin temperatures with constantan-copper thermocouples sutured to the selected sites.

Donor sites were used in this series of experiments designed to study the effect of cold on wound healing a process which involves in the skin fibrous tissue formation to replace the dermis and epithelial regeneration to restore the continuity of the epidermis. Under optimum conditions the healing of a dermatome donor site from which 0.016 inch of skin had been removed occurred spontaneously in from 8 to 10 days.

The process of tissue repair is a continuous interplay of cell migration combined with structural synthesis involving a sequence of biochemical reactions. The rate of both components of this process is influenced directly by the temperatures of the environment. Within a certain range of moderate temperatures either cold or warm the sole effect will be either a reduction or an increase in the rate of these reactions of repair. However, drastic reduction or increase of the temperature brings in its wake a whole sequence of changes which complicates and interferes with the optimal process of wound healing.

The observations recorded in this series of cases presented the results of study of the processes of epithelialization and fibrous tissue formation under different temperatures and durations of exposure but under controlled conditions. Combining the cold treated and the control areas into tabular form it is apparent that in the range of temperature between 82 and 53° F the time required for complete epithelialization of the area is inversely proportional to the height of the temperature and directly proportional to the time of exposure. In the range of cold temperatures from 65° to 53° F the delay of complete epithelialization was from 3 to 4 days for the standard dermatome donor area as compared with the controls.

Precooling of the area prior to the removal of the skin was carried out in one case. This particular experiment was attempted because it has been claimed that tissue irritation and hyperemia speed the processes of healing. The skin was removed at the height of hyperemia which followed the exposure of the patient's thigh for 72 hours to 60° F. The donor site was subsequently treated with Bettman's

gauze and a pressure dressing identical to these factors for the untreated control area. Healing occurred in about the same time as in the controls and grossly there was no difference between the two areas, either in appearance or in texture. The only conclusion that the authors could draw from this observation was that exposure of the skin to 60° F for as long as 72 hours prior to removal of the skin does not delay the healing of the donor area.

The authors' observations based on the treatment of donor sites under experimental and noninvestigative conditions show that application of a pressure dressing other things being equal speeds up spontaneous epithelialization of the donor area, reduces the amount of exudate, and keeps in check the subepithelial fibrosis. The principle of pressure dressing has been advocated and followed by many workers, and its utilization in the field of plastic surgery and for the treatment of burns and other injuries has been firmly established.

There have been many advocates of cold for the treatment of burns. The authors' observations based upon the experiments with laboratory animals, and experimental and clinical study of the effect of cold in man do not bear out the enthusiasm of these investigators. Application of moderate cold delays healing even under optimum conditions of repair and regeneration. It is difficult to combine a pressure dressing with the application of cold and consequently the pressure has to be dispensed with. The degree of cold required to check bacterial growth and disintegration of the tissue imposes additional damage on the part which is already injured by heat.

LOUIS T. STARR, M.D.

**Parenteral Nutrition. Studies on the Tolerance of Dogs to Intravenous Administration of Fat Emulsions.** HARVEY S. COLLINGS, LYNNEITH M. KRAFT, THOMAS D. KIRKNEY, CHARLES S. D. VIDSON and OTHERS. *J Lab Clin M* 948, 33-43.

Parenteral administration of fat is a means of securing a high caloric intake in a minimum of fluid volume. The high caloric intake protects the body proteins and should considerably improve the nutritional status of severely emaciated children or adults.

Previous studies on dogs revealed granulomatous lesions in the lungs and spleen and to a lesser extent in the liver produced by a 15 per cent fat emulsion.

In the present study a 30 per cent fat emulsion stabilized with soybean phosphatides (asolectin) was given. An initial increase in plasma fat was found

but normal values were approached within an hour after the infusion.

Control experiments have shown that the soybean phosphatide used as a stabilizer was primarily responsible for the production of granulomatous lesions.

ARTHUR J. LEMER, M.D.

**Parenteral Nutrition. Improved Techniques for the Preparation of Fat Emulsions for Intravenous Nutrition.** ROBERT P. GEYER, GEORGE V. MARY, and FREDRICK J. STARR. *J Lab Clin M* 1948, 11-33.

In the present study the size of the particles in the emulsions and their stability were investigated. It appeared desirable that all particles in the emulsion used should not be larger than normal chylomicrons. A photomicrographic method for determining the size of fat particles has been developed, and by means of high pressure homogenization, fat emulsions were prepared in which all particles were below 2 micron in diameter.

It was found that high pressure, high temperature, and continuous recirculation of the material and the proper amount of the fat stabilizer aided in the preparation of fine emulsions.

ARTHUR J. LEMER, M.D.

**Parenteral Nutrition. Studies on Soybean Phosphatides as Emulsifiers for Intravenous Fat Emulsions.** ROBERT P. GEYER, GEORGE V. MARY, JOHN YOUNG, THOMAS D. KIRKNEY and FREDRICK J. STARR. *J Lab Clin M* 1948, 33-165.

In this study attempts were made to eliminate the factors responsible for the granulomatous lesions which were produced by fat emulsion with a soybean phosphatide stabilizer. In experiments on albino rats and puppies it was again found that soybean phosphatide was the agent chiefly responsible for the production of granulomatous lesions.

Since previous studies have shown that the soybean was the best emulsifying agent, a chemical fractionation of the soybean phosphatide was attempted in order to find a fraction with good emulsifying, but little or no lesion-producing qualities.

In the final experiment 3 puppies received daily intravenous infusions of a 30 per cent fat emulsion prepared with a soybean fraction B (F<sub>2</sub>) obtained from a diethylether solution by a process described in detail by the authors. The experiment lasted from 3 to 84 days, and none of the puppies showed granulomatous lesions.

ARTHUR J. LEMER, M.D.

# SURGERY

## GYNECOLOGY AND OBSTETRICS

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### EVOLUTION AND TREATMENT OF TUBERCULOSIS OF THE HIP

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THE evolution of tuberculosis of the hip joint in patients seen in this clinic has been studied to determine the results of conservative and operative treatment as well as the optimum time for surgery and the efficiency of different surgical operations.

Thirty-one proved cases of tuberculosis of the hip followed for a minimal period of 4 years were chosen for this study. The tuberculous nature of the hip lesion was proved by positive guinea pig reactions to inoculations of abscess material or of tissue from the involved hip. In some instances the *Bacillus tuberculosis* was found on direct smear or in cultures of this material. Lesions of proved tuberculous nature in the viscera or other osteoarticular regions in patients with hip joint involvement were also considered as proof of the tuberculous nature of the hip joint lesion. Microscopic sections of tissue of the hip joint which showed pathological lesions described as typical of tuberculosis were not accepted as definite proof of the tuberculous nature of the process unless a positive reaction in guinea test was obtained from the same tissues. Granulomatous and necrotic lesions similar to those seen in tuberculosis can be produced by other organisms than the Koch bacillus.

The 31 cases chosen for this study do not represent a true cross section of the different

types of hip tuberculosis seen in this clinic. It is usually difficult to prove the tuberculous nature of hip lesions which are of very slow development and show no abscess formation and which develop in patients who are in good general condition and who years before the onset of the hip symptoms had minimal and clinically undetected pulmonary lesions. Many of these patients who had a probable but not proved tuberculous hip necessarily had to be excluded from our series whereas cases of patients with hip lesions of acute onset and stormy evolution were easily proved and many could be included in this study. However since the diagnosis of osteoarticular tuberculosis is so inaccurate when made on clinical and roentgenographic studies alone we have preferred to discard all the unproved cases even if by so doing the statistics do not represent a true picture of the different types of tuberculous hip disease. Many cases in which the follow up extended over a short period only or there was no follow up were also discarded.

For this study the cases were divided into three groups:

- 1 Primary para articular bone lesions—7 patients, all children
- 2 Tuberculosis of the hip joint in childhood (under 15 years of age)—15 patients.
- 3 Tuberculosis of the hip joint originating in the adult—9 patients 1 with bilateral hip tuberculosis.

From the Department of Orthopedic Surgery, State University of Iowa Hospitals.



Fig. a, Roentgenogram of the left hip of 6 year old boy shows an area of uniform bone destruction in the inner aspect of acetabular roof. The patient had mild pain in his left leg and limp for 6 months. Hip motion, as somewhat restricted in all directions. Roentgenograms of chest showed Gohn complex, which healed and calcified 1 1/2 years. A diagnosis of tuberculous osteitis of the ilium was made. The patient was immobilized in plaster hip spica for 3 1/2 years. b, Roentgenogram taken 3 years later shows the osteitic lesion practically healed. The patient had been

ambulatory for 3 1/2 years and had no symptoms. Roentgenogram taken 1 year later shows new activity in the area of the old lesion, and enlargement of the area of destruction. The joint space is somewhat narrow and there is generalized bone atrophy. Seven months before this picture was taken the patient started to have pain again and to limp on left leg. An intra-articular and extra-articular fusion and subtrochanteric osteotomy were done 1 month later. The synovium is moderately infiltrated with tuberculous granulomatous tissue. The superficial layers of joint cartilage are eroded.

From a pathological point of view there is no sound basis for studying osteoarticular tuberculosis in children in a group separate from the adults. Types of destruction of similar character can be seen in children as in adults because it is not the age which regulates the different types of osteoarticular tuberculosis but the date of the primary infection (6). However it is usually in children in whom we see the most actively destructive lesions because contacts with the *Bacillus tuberculosis* occur early in life in a great proportion of the population. On the other hand the anatomical and physiological characteristics of the osteoarticular system and its capacity for repair change with the years. In tuberculosis as in any other infectious processes of the bones and joints the evolution of the process

#### PATIENTS WITH PRIMARY PARA-ARTICULAR BONE LESIONS

A circumscribed area of bone destruction close to the hip joint was observed in 7 patients, all of them children—5 boys and 2 girls. Their ages at the onset of symptoms varied from 1 to 5 years. In 3 patients the lesion was localized in the femoral neck, close to the metaphysis, whereas in the other 4 patients the lesion was located in the ilium, close to the roof of the acetabular cavity. No primary foci of



Fig. 2 a, Roentgenogram of the right hip of a 6 year old boy. There is a focus of irregular bone destruction in the inner aspect of the femoral neck. The head of the femur is somewhat separated from the inner wall of the acetabular cavity. Seven months previously following a fall the patient awoke at night screaming with sharp pain in right hip. This pain reappeared periodically. He had a limp due to pain and to flexion contracture in the hip. b, The lesion in the femoral neck consisted of an extensive area of primary caseation necrosis containing sequestered bone. c, The synovia in the lower aspect of the joint was very thick and contained abundant tuberculous granulation tissue with no caseation. The guinea pig test was positive for tuberculosis.



depending on the age of the lesion. An area of surrounding sclerosis represents limitation of the process which appears when the lesion has already been present several months. Biopsy in one of these lesions revealed tuberculous granulation tissue occupying the marrow spaces and eroding and destroying the bone trabeculae. Small areas of caseation were very scarce in the granulation tissue.

In the 4 remaining patients the roentgenograms showed the area of bone destruction to be partially filled with one or several dense bone sequestra of different size and shape (Figs 2 3 and 4). A wall of dense bone was seen surrounding this area. The biopsy in 2 of these cases showed these sequestra to be formed by dense trabeculae of dead bone. The marrow spaces were occupied by caseated marrow tissue with some of its structures still faintly discernible in places, indicating

that the lesion represented a primary caseation of the marrow (Fig 2b). Surrounding the sequestra were caseated material and debris with a few scattered areas of tuberculous granulation tissue polynuclears and chronic inflammatory cells. The first type of lesions was designated granulous osteitis, because of the abundance of tuberculous granulation tissue. The last type of lesions is called caseous osteitis because of the abundance of primary caseation necrosis of the marrow tissues (6 to 11).

In most children there was a tendency for both types of tuberculous osteitis treated conservatively to become limited and walled off. The bone sequestra were slowly destroyed and later new bone trabeculae filled in the cavity (Fig 4). In a few years the old lesion had disappeared from the roentgenograms. In certain cases however the lesion reap-



Fig. 3. Roentgenogram of 4-year-old girl 5 months previous. The patient started limp and then marked and continuous pain in the left hip. The best negative biopsy showed extensive focus of caseous necrosis in the ilium containing large bone sequestrum. The guinea pig test was positive for tuberculosis.

peared and even enlarged when immobilization was discontinued and weight bearing and freedom of motion were resumed. Even if the primary focus of osteitis disappeared completely the hip joint in each of the 7 patients was affected sooner or later by the tuberculous process regardless of treatment. It was very difficult from clinical and roentgenographic examinations to ascertain when the hip joint was first invaded by the spreading of the focus of tuberculous osteitis. We have never seen a patient with a focus of osteitis adjacent to the hip joint complaining of only osteocopic pain, but invariably pain of arthritic character was present on admission. The patient may have occasional pain in the hip and a slight limp and he often cries at night. On clinical examination a few degrees of limitation of motion are noted and pain accompanies extreme degrees of motion. The roentgenograms show a localized osteitis with a seemingly normal hip joint. However when biopsy is done at this time the synovia adjacent to the bone lesion is found already invaded by tuberculous granulation tissue (Fig. 2).

Further joint involvement may proceed in a slow progressive manner or the joint may

become rapidly destroyed a few months after the onset of the osteitic lesion. In 3 of our patients roentgenographic evidences of joint destruction were not seen until 1½ to 4½ years after the onset of symptoms. The roentgenograms later on showed further narrowing of the joint space with some marginal bone destruction atrophy and irregular minimal spotty destruction of the subchondral bone, and generalized bone atrophy. The limitation of motion in the hip progressed the hip pain became more continuous, the child limped markedly and flexion and adduction contractures of the hip joint developed and progressed slowly. One patient had sharp increase of pain and some fever 4 years after onset of symptoms. The roentgenograms, which had been showing a slowly progressive joint destruction revealed marked increase of bone destruction a few weeks after the acute episode a wandering acetabulum and extreme bone atrophy (Fig. 4). The pathological examination of the joints which were slowly destroyed by the tuberculous process showed the synovia replaced by thick tuberculous granulation tissue with many typical tubercles present. Caseation of the tubercles was very rare. At the joint margins granulation tissue formed a pannus creeping over the joint surface and eroding the joint cartilage. The subchondral bone showed osteoporosis and nonspecific granulation tissue was slowly destroying the bone cartilage from underneath. Very rarely were miliary tubercles found in the subchondral spaces. Overgrowth of hyaline and fibrocartilage was seen at the periphery of the joint in one instance (Fig. 6).

In 4 of our patients the hip joint was involved and rapidly destroyed only a few months after the onset of symptoms from a para articular focus of osteitis. In 2 of these patients the joint was involved following biopsy and removal of the focus of osteitis, 7 and 10 months after the onset of symptoms. The joints in both cases were completely destroyed after a few months of a stormy post-operative course with fever pain increased sedimentation rate, and elevated white blood count. In the other 2 patients the joints became ostensibly involved as seen on the roentgenograms, and were rapidly destroyed 2 and



Fig. 4. a, Roentgenogram of the left hip of a 22 month old boy taken on September 23, 1940. It shows a focus of osteitis in the femoral metaphysis containing one sequestrum. The child limped on left leg when he began to walk at 17 months of age. Occasionally complained of pain in the hip which was in 30 degrees flexion contracture. The patient was immobilized in plaster hip spica. b, Roentgenogram taken on May 16, 1941 shows that the bone sequestra are being absorbed. The joint space is somewhat narrow. Later on the patient was symptomless and began to walk in July 1943. Half a year later he developed flexion contracture in same hip. c, Roentgenogram taken on May 1, 1944 shows the lesion of the femoral metaphysis to be healed. However the upper joint space is narrow and the femoral head is separated from the inner wall of the acetabular cavity. Subchondral cystic destruction is seen in the femoral head. The patient was again immobilized. d, Roentgenogram taken in July 1945 shows advanced destruction of the femoral head and acetabular roof. e, Roentgenogram taken on January 14, 1946, 6 months after a British operation. The bone graft is seen eroded and fractured. A soft tissue abscess is present medial to the upper femoral shaft, at the site of the bone graft. Guinea pig test was



positive for tuberculosis. The patient is still under treatment.

5 months after the onset of symptoms due to the fast spreading of the focus of osteitis (Fig 5). The joint invasions in these cases were characterized by very acute clinical symptoms such as an extreme amount of pain, high temperature—103 degrees, complete fixation of the joint due to muscle spasm, elevated white blood count, elevated sedimentation rate and low hemoglobin. Great destruction of the femoral head and of the acetabular roof could be seen a few months later in the roentgenograms. The pathological examination in one of these patients showed the predominance of caseation necrosis in the synovia and in the subchondral bone with destruction of the joint cartilage.

According to our experience the type of pathological lesions seen in the involved joint

was not always of the same character as in the lesions found in the original focus of osteitis. Biopsy in 2 patients for example with an extra articular tuberculous focus showed the bone lesion to be a caseous osteitis as it was formed by bone sequestra surrounded by caseated marrow with no tubercles. The synovia adjacent to this focus of bone destruction showed on the other hand tuberculous granulation tissue with typical tubercles and no caseation (Figs 2 and 3). However the joint became rapidly destroyed in both cases after caseous material was implanted into the joint at the time of operation.

The causes for the predominance of the caseous or the granulous type of lesions in tuberculous osteitis and osteoarthritis are obscure but probably are related to changing allergic





Fig. 3. Roentgenogram of 4-year-old girl. Six months previously the patient started to limp and to have marked and continuous pain in the left hip. The chest negative. Biopsy showed extensive focus of caseous necrosis in the ilium containing large bone sequestrum. The guinea pig test as positive for tuberculous.

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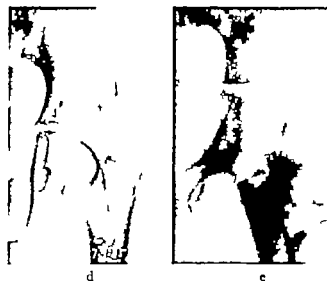
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In 4 of our patients the hip joint was involved and rapidly destroyed only a few months after the onset of symptoms from a para-articular focus of osteitis. In 2 of these patients the joint was involved following biopsy and removal of the focus of osteitis, 1 and 10 months after the onset of symptoms. The joints in both cases were completely destroyed after a few months of a stormy post-operative course with fever, pain, increased sedimentation rate and elevated white blood count. In the other 2 patients the joints became ostensibly involved as seen on the roentgenograms, and were rapidly destroyed 2 and



Fig. 4. a, Roentgenogram of the left hip of a 23 month old boy taken on September 23, 1940. It shows a focus of osteitis in the femoral metaphysis containing one sequestrum. The child limped on left leg when he began to walk at 11 months of age. Occasionally complained of pain in the hip, which was in 30 degrees flexion contracture. The patient was immobilized in plaster hip spica. b, Roentgenogram taken on May 16, 1941 shows that the bone sequestra are being absorbed. The joint space is somewhat narrow. Later on the patient was symptomless and began to walk in July 1943. Half a year later he developed flexion contracture in same hip. c, Roentgenogram taken on May 1, 1944 shows the lesion of the femoral metaphysis to be healed. However, the upper joint space is narrow and the femoral head is separated from the inner wall of the acetabular cavity. Subchondral cystic destruction is seen in the femoral head. The patient was again immobilized. d, Roentgenogram taken in July 1945 shows advanced destruction of the femoral head and acetabular roof. e, Roentgenogram taken on January 14, 1946 6 months after a Brittain operation. The bone graft is seen eroded and fractured. A soft tissue abscess is present medial to the upper femoral shaft, at the site of the bone graft. Guinea pig test was



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According to our experience the type of pathological lesions seen in the involved joint

was not always of the same character as in the lesions found in the original focus of osteitis. Biopsy in 2 patients for example with an extra articular tuberculous focus showed the bone lesion to be a caseous osteitis as it was formed by bone sequestra surrounded by caseated marrow with no tubercles. The synovia adjacent to this focus of bone destruction showed on the other hand tuberculous granulation tissue with typical tubercles and no caseation (Figs. 2 and 3). However the joint became rapidly destroyed in both cases after caseous material was implanted into the joint at the time of operation.

The causes for the predominance of the caseous or the granulous type of lesions in tuberculous osteitis and osteoarthritis are obscure but probably are related to changing allergic



Fig. 5. a, Roentgenogram of a 3 1/2 year old boy showing small area of destruction in the acetabular roof. The patient had mild pain in the right hip and knee for 1 month. Shortly after this roentgenogram was taken the patient fell and injured the right hip. After that he started to have high temperature and great deal of pain in the same hip. The osteitic lesion had opened into the hip joint. The patient was then immobilized in hip spica cast. b, Roentgenogram taken 10 months later. The hip joint had been destroyed. A new acetabular roof is broadly delimited. c, Roentgenogram taken 2 years later just before surgery. What was left of the femoral head and acetabulum appear well resorbed. The joint space is very wide and contains several sequestra. The patient died of shock shortly after surgery. Examination of the hip showed the joint space to be occupied mostly by hyaline cartilage and fibrocartilage. A few pieces of dead bone are lying destroyed in granulation tissue. Areas of caseation necrosis partially calcified were seen here and there. A few tubercles surrounded by concentric layers of fibrous tissue were also seen.

conditions in the patient (6). However it must be emphasized that only in the early stages of osteitis or synovitis can pure caseous or granulous lesions be found. These two types of tuberculous lesions will be seen intermingled sooner or later in any tuberculous process although one of the lesions will predominate over the other (5, 9).

According to our experience once the hip joint became involved it either fused spontaneously or a fusion operation had to be performed. This was necessary because of persistent pain increasing joint destruction and flexion and adduction contractures. Four patients were treated by prolonged immobilization in plaster casts—two hips became ankylosed 3 years after onset of symptoms due to the focus of osteitis and approximately 2 1/2 years after the joint invasion. The other 2 hips did not become ankylosed until 3 1/2 and 5 years after the joint invasion. Obviously the joints rapidly destroyed by a caseous process became ankylosed faster than the joints which were slowly destroyed by a granulomatous type of lesions. Three patients were operated upon. A Brittain fusion was performed

in 1 patient 5 years after the onset of symptoms and failed because of absorption of the bone graft. This patient is still under treatment. An intra-articular and extra-articular fusion plus a subtrochanteric osteotomy has been performed recently in another patient 5 years after the onset of symptoms. An extra-articular fusion was performed in 1934 on another patient 3 years after the joint invasion. The patient died of shock shortly after the operation.

The following observations taken from this study concerning the evolution of tuberculous para-articular foci about the hip joint are in agreement with those in most of the reports in the literature.

1. Extra-articular foci of osteitis are seen more often in children and very rarely in adults.
2. The femoral head is almost never involved by a primary focus of tuberculous osteitis.
3. The hip joint becomes involved sooner or later in the great majority of patients, regardless of whether the treatment of the focus of osteitis has been conservative or operative.



Fig. 6. a, Roentgenogram of the right hip of a 4 year old boy taken in October, 1931. There is atrophy of the upper femur and pelvis, and an area of bone destruction with irregular dense calcification is seen in the femoral neck. The patient limped and had pain in right knee and hip for 5 months. The right hip was in marked flexion, abduction, and outward rotation contracture. The right leg was placed in traction and later in a hip spica plaster cast. b, Roentgenogram taken 2 years later shows that the lesion in the femoral neck has been displaced distally due to the growth of bone at the epiphyseal plate. The contours of the lesion are less sharp. The upper femur is very atrophic and the joint capsule is distended. The femoral head is somewhat flat and the subchondral bone is irregular. c, Roentgenogram taken 4 years after onset of symptoms. The lesion of

the femoral neck has disappeared. The joint space is narrow. There is a new area of bone destruction in the outer aspect of the femoral head. Biopsy and exploration of the hip were performed at this stage. d, Represents the outer margin of the femoral head. There is overgrowth of hyaline cartilage at the area of bone destruction seen in the roentgenogram. A pannus formed of granulation tissue and fibrous tissue was covering the surface of the joint cartilage (the wrinkling of the pannus is an artefact). There is chronic, and for the most part nonspecific, granulation tissue in the marrow spaces of the subchondral bone. The capsule was thickly infiltrated by tuberculous granulation tissue with many typical tubercles. Caseation of the tubercles was rarely seen. Guinea pig inoculation was positive for tuberculosis.

Hatcher and Phemister reported that in only 2 of 26 children did the lesion which was centrally located in the femoral metaphysis heal without joint involvement. Cholmeley reported that of 55 patients only 3 recovered with an intact hip joint. 1 had a focus of osteitis in the greater trochanter which was removed surgically and in the 2 others the lesion was localized in the ilium over the cotyloid rim and in the medial wall of the acetabulum.

From these findings we know then that the focus of tuberculous osteitis about the hip joint will take years to heal if conservative treatment with plaster cast immobilization is employed but in spite of this treatment the joint will become involved in the great majority of cases. Drainage and curettage of the focus of osteitis will not save the joint either unless the focus is located in the greater trochanter or occasionally in the ilium at some distance from the hip joint. Based on this experience we believe that treatment of the focus of tuberculous osteitis close to the hip joint must be directed toward obtaining an ankylosed joint as soon as there is clear evidence that the destructive process of osteitis remains well localized and the general condition of the patient is satisfactory. Care should be taken not to disturb the focus of osteitis a step easily accomplished when the focus of osteitis is located either in the medial aspect of the femoral neck, ischium or in the middle aspect of the ilium. However if the focus of osteitis is located in the lateral aspect of the femoral neck or of the acetabulum a hip fusion operation will necessarily disturb the osteitic lesion and the tuberculous process may be exacerbated and may spread widely. It may be wise in these cases to delay surgery until the healing of the osteitis is well advanced.

#### TUBERCULOSIS OF THE HIP JOINT IN CHILDREN

Fifteen patients with tuberculous arthritis of the hip joint which started during childhood were studied. Eight were seen from 1 to 10 months after the onset of symptoms and no foci of osteitis were present on the roentgenograms, a fact suggesting a synovial origin of the tuberculous process. Seven patients were seen from 1 to 50 years after the onset

of symptoms. The hip joint in these patients was extensively destroyed on admission so that it was not possible to ascertain if the tuberculous arthritis had originated from a focus of osteitis or from a primary synovial tuberculosis. The ages of the patients at the time of onset of symptoms varied from 1 to 12 years, 5 years being the average.

Röntgenograms of the chest were taken on admission in all patients and at least every year while under our supervision. Five patients from 2 to 11 years of age had pulmonary lesions with the characteristics of a primary complex. This lesion was healed on admission in 3 patients and in the other 2 healing rapidly progressed. The chest plates of 7 patients never showed any tuberculous lesions while under our treatment although in 2 of them there was some perihilar infiltration. Two patients developed new pulmonary tuberculous lesions 12 and 14 years after the onset of the hip lesion. One patient died of miliary tuberculosis 1½ years after onset of the hip tuberculosis. Two patients developed tuberculosis of the spine 14 and 50 years after the tuberculosis of the hip.

The onset of hip tuberculosis in children was usually insidious during the first few weeks or months. The patients often cried at night and had slight limp but the hip was painless during the day time. Later on the hip pain became acute and constant and there was fever which went up as high as 104 degrees in some instances. The patients limped badly, weight bearing being sometimes impossible because of pain. The patients lost weight, the thigh became markedly atrophic and contracture deformities of the hip developed in a few weeks or in a slow manner in several months. In 12 patients the leg was in marked flexion and adduction, contracture on admission and in 3 patients the thigh was in marked flexion, abduction and outward rotation. There were only a few degrees of motion in the hip joint of most patients, due to pain and muscle spasm. The sedimentation rate was increased and the hemoglobin and red blood count were low. The elevated white blood count was invariably related to the development of an abscess and in some patients it reached as high as 16,000. The guinea pig inoculation with fluid obtained

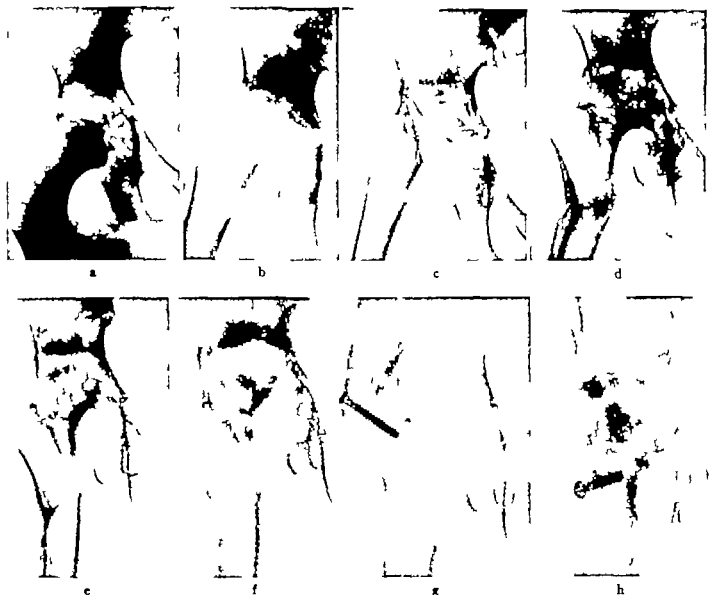


Fig. 7 a, Roentgenogram of the right hip of a 6 year old patient, taken in September 1939. The subchondral bone of the femoral head and acetabulum appear destroyed. The joint space is wide. The patient started to limp 3 months before this picture was taken and had acute pain in the hip during the last 2 weeks. The leg was in flexion and adduction contracture. There was an abscess in the adductory region, which was aspirated. The acid-fast smear and the guinea pig inoculation were positive. Traction was applied on the right leg for 1 week, followed by plaster hip spica. b Roentgenogram taken 9 months later. The joint space is very narrow and the shadow of an abscess is seen between the ischium and the femur. c, Roentgenogram taken 1 year and 8 months after onset of symptoms. It shows re-ossification of the femoral head and ilium. The joint space is still very narrow. The general condition of the patient was good. In May 1941 a subtrochanteric osteotomy was performed (Parks). d, Roentgenogram taken 3 months after osteotomy. The joint space has started to become

wider. The femoral head shows a focus of bone destruction. There were a few degrees of painless motion in the hip. e, Roentgenogram taken 3 years after onset of symptoms shows very wide joint space and some activity of the tuberculous process in the femoral head. There was no pain or muscle spasm and range of motion in the hip was fairly good. The patient was then allowed to walk on crutches. f Roentgenogram taken 1 year later shows advanced destruction of the femoral head. The joint space remains wide. The patient had some pain and recurrence of the adduction and flexion contractures. An extra-articular arthrodesis was performed 3 months later. g, Roentgenogram taken 3 months after the extra articular arthrodesis. There is no longer bony contact between the tibial grafts and the trochanter. The joint space remains wide. Another extra articular fusion had to be performed in April, 1944. h, Roentgenogram taken 1 year and 10 months after the second extra-articular fusion. Bony fusion has not yet become solid.

from the joint or from the abscess was positive in 10 patients negative in 1 and it was not taken in 4 patients. In 5 patients Corper's media culture of the joint or abscess material

was positive and in 3 patients the direct smear was positive. No attempts were made to differentiate between the human and bovine types of *Bacillus tuberculosis*.

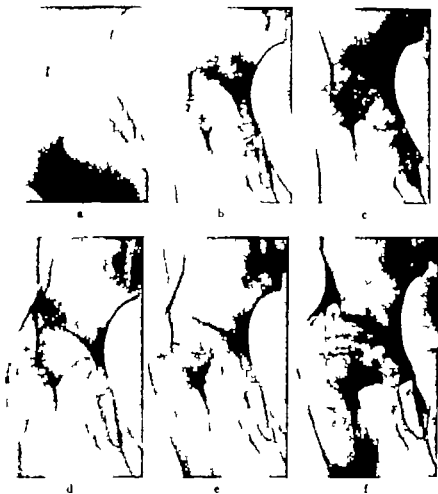


Fig. 8. a, Roentgenogram of the right hip of a 4 year old boy who had pain in this hip and limped for 9 months. The femoral head appears to be subluxated posteriorly. The acetabular roof is destroyed. The right leg was in extreme flexion and abduction contracture. Traction was applied on the right leg for 4 months, followed by plaster hip spica. A warm abscess appeared 6 months later on the posterolateral aspect of the hip region. The abscess was aspirated, ice and sinus opened and drained for 2 months. The acid-fast smear and guinea pig inoculation were positive for tuberculosis. b, Roentgenogram taken 1 year later shows the femoral head to be replaced in the acetabular cavity. The joint space is hazy and narrow. c, Roentgenogram taken 3 years and 3 months after onset of symptoms shows a well advanced reossification of the iliac bone and upper femur. The contours of the femoral head and upper acetabulum are well delineated. The joint space is wide. There is some painless motion in the hip. An extra-artic-

ular arthrodesis was performed at that time. d, Roentgenogram taken 3 months after extra-articular fusion. Bone atrophy of the middle portion of the bone graft is already evident. Roentgenogram taken 9 months after the operation. The middle portion of the bone graft has been completely absorbed. The joint space is very wide. The femur appears abducted. A second extra-articular arthrodesis was then performed. The new bone graft also became reabsorbed in its middle portion but few months later new bone trabeculae bridged the defect. A subtrochanteric osteotomy had to be performed 1 year after the second arthrodesis operation in order to correct a progressive adduction contracture. f, Roentgenogram taken 34 years after the second extra-articular arthrodesis. The middle portion of the bone graft which was applied at the time of the second operation is atrophic. The joint space is still visible. Clinically there was no motion nor pain in the hip joint.

The roentgenograms of children who were seen early in the evolution of the tuberculous process showed that the hip joint was rapidly destroyed in all the patients. The joint space became narrow a few months after the onset of symptoms. Shortly after there was exten-

sive destruction of the bone of the acetabular cavity and of the femoral head. There was generalized bone atrophy of the iliac bone and upper femur.

In several instances it was found the joint space became wider and the joint capsule ap-



Fig. 9. a, Roentgenogram of the left hip of a 2 year old boy taken 4 months after acute onset of pain in the hip and femur. The femoral head and acetabulum appear completely destroyed. The patient had refused to walk since onset of pain. On admission the left leg was in flexion, abduction and outward rotation contracture and any attempt to move the hip caused great pain. The left leg was placed in traction for 2 weeks and then in a plaster hip spica. An abscess developed in the lateral aspect of the thigh 1 year after onset of symptoms. This was aspirated once and the guinea pig test was positive for tuberculosis. b, Roentgenograms taken 1 year and 8 months after onset of symptoms. New dense bone trabeculae are seen in the trochanteric region and in the femoral neck. A newly formed acetabular roof appears dense and well outlined. The joint space is wide. c, Represents a low power photomicrograph of a portion of the surface of the femoral head covered by a thick layer of fibrous tissue. This specimen was obtained during the hip fusion performed shortly after the stage represented by Figure 9b. The entire joint cartilage had disappeared during the active stage of the disease. No signs of tuberculous activity can be seen in the subchondral bone or in the fibrous tissue covering it. This fibrous tissue which also covered the acetabular roof was completely removed at the time of surgery and the joint space was packed with bone grafts from the tibia and ilium. d, Roentgenogram taken 3 months after intra-articular and extra-articular arthrodesis. The hip is already solidly fused. The femur was placed in 20 degrees abduction to compensate for the shortening of the left leg. e, Roentgenograms taken 3 1/2 years after surgery. The hip is well fused and the tuber-



tuberculous process is healed. The position of the femur in abduction had not changed.

peared distended during the first months of the disease due to the collection of debris and caseous material inside the joint. The subchondral bone appeared irregularly destroyed and atrophic in these hips. It was not until a few months later that the joint capsule burst open and the intra-articular debris emptied into the soft tissues forming an abscess. The joint space then became narrow and it was possible for what was left of the bone of the femoral head to establish contact with the irregular acetabular roof (Figs. 7, 8 and 9).

In 12 children a tuberculous abscess was seen on admission or it became ostensible while under treatment from 3 months to 3 years after onset of symptoms. 14 months was the average period. In 4 patients the abscess could be seen on the roentgenograms but they could not be detected by clinical examination.

When the tuberculosis of the hip joint was very active the abscess was big, warm, difficult to visualize on the roentgenograms and had a tendency to break through the aponeu-





Fig. 8. Roentgenogram of 53-year-old man who had severe loss of the hip joint because of tuberculosis of age 23 years of age. There is slight springy motion of the hip joint and the thigh 5 degrees abduction and 30 degrees flexion. The patient had flare-ups of the hip process during his life each of several months during his life and draining sinus formed in. A double hant re osteotomy proposed to the patient but he refused surgery.

rosis and the skin. On the other hand, when the tuberculous lesion improved the abscess became well delimited and caught on the roentgenograms an opalescent shadow sometimes quite dense (6). In 8 patients the abscess became absorbed and disappeared in 2 to 5 years; it was necessary to aspirate the abscess several times in 3 of these patients.

Four patients seen by us from 1 to 50 years after onset of symptoms developed draining sinuses which persisted for several years. The probable causes for the persistence of the draining sinuses were as follows: Intra-articular sequestra were seen on the roentgenograms of 2 patients whose hips were secondarily infected. The drainage ceased in one of these patients after extrusion of the sequestra and spontaneous ankylosis of the hip joint whereas draining sinuses reopened for 5 years off and on in the other patient who still has motion in the hip joint. A 9-year-old patient was seen in this clinic 4 years after onset of his symptoms, with a draining sinus over the iliac crest of 2 years' duration. The roentgenograms showed extensive destruction of the hip joint and bone sclerosis over the iliac wing along the sinus tract. Extensive immobilization and repeated sinus resections failed to control the drainage which was due to secondary infection. The hip joint became ankylosed

6 years after admission but the drainage persisted. The patient died of generalized amyloidosis 15 years after onset of the hip disease. Another patient was a 52-year-old male who had had tuberculosis of the hip joint ever since the age of 2 years and had had a draining sinus during short periods of his life. The thigh was in a position of 50 degrees adduction and the hip joint which was completely destroyed, never became ankylosed because of the faulty position of the leg into adduction. The tuberculous process became reactivated periodically (Fig. 10).

In all the patients seen during the first 2 years of the disease the faulty position of the hip was easily overcome in a few weeks of traction, and then plaster cast immobilization controlled the pain and gave comfort to the patient. The general condition of the patients improved slowly. In only 1 patient was a recrudescence of the lesion observed which occurred 1 year after the onset of treatment. The roentgenograms taken during the second year of the hip disease showed resuscitation of the atrophic bone. Portions of the femoral head and acetabulum which appeared as if



Fig. 9. Roentgenogram of the left hip of 24-year-old woman who had tuberculosis of the hip 10 years of age. The patient received no treatment. The hip had been asymptomatic for 10 years when first saw her and remained so during the 13 years of follow-up in this clinic. The patient was treated for tuberculosis of the spine and lungs, and the hip remained asymptomatic and freely movable.

they had been destroyed during the acute stage also became reossified. This reossification was usually irregular and a few dense new bone trabeculae were seen crossing the atrophic area. The bone contours became well demarcated and the shadow cast by the tuberculous abscess became denser, evidently due to deposition of calcium salts in the caseated debris (Figs 7, 8 and 9). Clinically there was simultaneous improvement of local and general symptoms. The joint motion although limited was painless and no pain or muscle spasm was produced when the leg was gently shaken by the foot. There was no fever and the sedimentation rate, red blood count and hemoglobin approached normal readings. The tuberculous abscess if present became smaller. The white blood count remained somewhat elevated until the tuberculous abscess disappeared completely. This clinical improvement together with the reossification of the atrophic and partially destroyed bone occurred in 8 patients from 1½ to 2½ years after onset of symptoms. In 2 patients it occurred 3 years and in 1 patient 4 years after onset. One patient died of miliary tuberculosis and another had a secondary hip infection and died of amyloidosis. Two patients came to us years after the onset of disease and it was not possible to ascertain when this healing reaction had appeared.

During this stage of reossification the joint space remained narrow but in the roentgenograms taken a few months later it was seen in 8 patients that the joint space was becoming wider (Figs. 7 and 8). This widening of the joint space was remarkable in 2 patients who were allowed early hip motion. It was also seen in patients who were immobilized in plaster cast and remained in bed for long periods. Lorenz advised the practice of very early weight bearing and ambulatory treatment to his patients immobilized in plaster cast in order to bring the bone of the femoral head and the acetabulum into close contact thus favoring early joint ankylosis. This practice has not been followed by many orthopedists because early weight bearing may often reactivate the hip tuberculosis.

Material for histologic study was obtained from all the patients operated upon but in



Fig. 2. Roentgenogram of the left hip of a 62 year old woman taken 3 months after an intra articular and extra articular arthrodesis plus subtrochanteric osteotomy. The hip was solidly ankylosed. Notice that after the osteotomy the upper femoral fragment went into abduction due to the action of the gluteus medius, thus determining pressure stresses over the extra-articular bone graft and over the denuded hip joint area. This stimulated new bone formation and resulted in fusion.

only 4 patients who had an intra articular and extra articular fusion were we able to study the hip joint well. Three of these patients were operated upon 2 to 4 years after onset of symptoms and 1 patient was operated upon 14 years after. The synovia and joint capsule were fibrotic thickened and adherent to each other. In the midst of the scar tissue small encapsulated foci were seen with necrotic cells and a few epithelioid cells. Foam cells containing lipoid substance were also seen in 2 instances. Extensive portions of the joint cartilage had been destroyed and the remaining cartilage was invaded by nonspecific granulation tissue. There was fibrosis of the marrow which contained only a few tubercles well surrounded by connective tissue. Small areas of caseous necrosis were being substituted by young connective tissue. Active new bone formation was widespread. The joint space was wide in 2 patients due to thick and poorly vascular fibrous tissue and fibrocartilage which covered the femoral head and acetabulum (Fig. 9c). This fibrocartilage

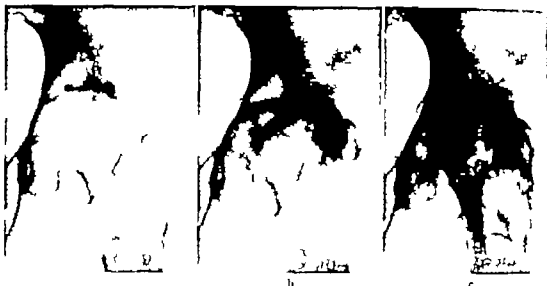


Fig. 3 a, Roentgenogram of a 5 year old woman who had pain in the left hip off and on for 5 years. The joint space is very narrow and there has been minimal destruction of the femoral head and acetabulum. The patient has healed pulmonary tuberculosis. b, Roentgenogram taken 1 year after extra-articular fusion. The patient started walking 1 year after the operation and had no pain nor motion in the hip. c, Roentgenogram taken 5 years after fusion. The hip is solidly ankylosed.

was being slowly invaded by marrow tongues and new bone trabeculae.

The end results in the 15 patients with tuberculosis of the hip which started in childhood were as follows:

1. No arthrodesing operations were performed in 6 patients. The hip joint of 1 patient who had never been treated was stable, painless, and had good range of motion (Fig. 11). In another patient treated by prolonged immobilization in plaster cast the result was a freely movable but unstable hip. In 2 patients treated by plaster cast immobilization the hip became ankylosed 5 and 14 years after onset of symptoms. A 52 year old male had tuberculosis of the hip for 50 years with several flare ups and draining sinuses off and on. The leg was in 50 degrees adduction and there was slight springy motion at the hip which never became ankylosed in spite of prolonged immobilization (Fig. 10). A subtrochanteric osteotomy and adductor tenotomy were advised but the patient refused surgery. One patient died of amyloidosis after 11 years of continuous drainage from the hip which did not respond to treatment.

2. Four patients from 6 to 10 years of age were treated by immobilization in hip spica

cast followed by extra articular arthrodesis of the hip joint. Two patients were operated upon 2½ years after onset of the disease, and their hip joint became solidly ankylosed in 2 years. The 2 other patients were operated upon 4 years after onset when the roentgenograms showed a wide clear space between the femoral head and the acetabular cavity. The hip joint failed to become ankylosed in both patients and the roentgenograms taken a few months after surgery showed absorption and fracture of the bone graft. A second extra articular operation was performed on the same patients 10 months later. Solid ankylosis was not obtained until 3 and 4 years after the second operation. The fibrous tissue filling the wide joint space at the time of surgery was no doubt responsible for delaying the growth of bone trabeculae across the hip joint (Figs. 7 and 8).

3. Four patients were treated by immobilization in hip spica cast followed by intra-articular and extra articular arthrodesis of the hip joint. Three patients were from 5 to 9 years of age at time of surgery which was performed 2 to 4 years after the onset of the disease. A 26 year old female was operated upon when she came to our service because

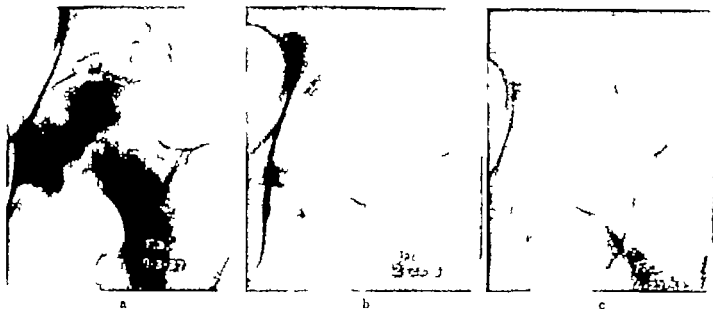


Fig. 14. a, Roentgenogram of a 31 year old woman who had pain and limitation of motion in the left hip for 6 months. Generalized bone atrophy and narrowing of the joint space can be seen. The patient had pulmonary tuberculosis for 10 years. b, Roentgenogram taken 5 months later shows extreme bone atrophy of upper femur and acetabulum, and great narrowing of the joint space. A wedge-shaped sequestrum can be seen in the upper margin of the femoral head (arrows). There was an extensive abscess around the hip joint. c, Roentgenogram taken 8 months later shows no joint space. It looks as if this had melted away. The wedge shaped sequestrum appears somewhat fragmented. The patient died shortly after of pulmonary tuberculosis and tuberculous pericarditis. d, Represents a low power photomicrograph of a section through the wedge-shaped sequestrum of the femoral head. There is extensive necrosis of all the marrow elements. The joint cartilage had been completely destroyed.



of a painful tuberculous hip she had had since 12 years of age. The hips of these 4 patients operated upon became solidly ankylosed from 2 to 6 months after operation, 4 months being the average. There were no operative or postoperative complications. The hips were not dislocated at the time of operation and only the fibrous tissue and fibrocartilage that could be curetted out from the periphery of the joint was removed. The denuded portion of the joint space was packed with cancellous bone and extra articular grafts were applied. Care was taken not to damage the vessels of the capsule (Fig. 9).

A 5 year old patient came to the clinic 6 months after onset of a tuberculosis of the hip. Two months later an incision was made over

the lateral aspect of the upper thigh with the idea of doing a subtrochanteric osteotomy as advised by Farkas in 1939. However the osteotomy was not performed because a wide spread deep abscess was encountered. This abscess became secondarily infected and the patient died of miliary tuberculosis 6 months after surgery.

From this study of 15 proved cases of tuberculosis of the hip in children the following observations have been made:

1. The treatment of tuberculosis of the hip must aim at fusion because only in rare exceptions is a stable, painless and movable hip joint obtained.

2. Surgery must be delayed until the general condition of the patient is satisfactory and



Fig. 5. a, Roentgenogram of the left hip of a 50 year old man who had had pain in the hip for 6 months. There is advanced destruction of the femoral head and destruction of the acetabulum, but no bone troph. Pus as aspirated from the hip joint. The smear culture and guinea pig inoculation were positive for tuberculosis. The lungs were negative. The hip was immobilized in hip spica for 3 years. b, Roentgenogram taken 3 years later showing more destruction of the femoral head. The patient had a very big abscess in the left thigh which was aspirated many times. There was fairly good range of motion in this hip which was only slightly painful. c, Roentgenogram taken 3 years later showing absence of the femoral head. The tuberculous abscess had disappeared and the general condition of the patient was excellent. d, Roentgenogram taken 7 years after onset of symptoms. The femoral head and acetabulum had been completely destroyed. The left hip was freely movable but unstable. The patient had no pain.

the roentgenograms show a sound reossification of the atrophic and of some of the previously destroyed bone. This 'healing reaction' appears usually from  $1\frac{1}{2}$  to 3 years after onset of hip symptoms, if a good general and local treatment is followed.

3. A warm widespread abscess is a contraindication for surgery. A cold, well local

ized abscess is not a contraindication. Lung tuberculosis was never a contraindication to surgery in children because the process healed long before the healing reaction occurred in the osteoarticular tuberculous lesion.

4. Extensive immobilization of the leg in hip spica casts should not be looked upon as an innocuous treatment and should not be pro-

longed any longer than necessary. Great atrophy shortening of the extremity and possible permanent damage to the epiphyseal plates about the knee and stiffening of the knee joint are frequent sequelae of prolonged immobilization (7).

5 As a rule, the optimum time for surgery is during the third year of the disease. If surgery is delayed beyond the third year the joint space may increase in width due to overgrowth of fibrous tissue and fibrocartilage which substitutes the destroyed joint cartilage.

6 Extra articular fusion will bring about prompt hip ankylosis only if there is contact between the bone of the femoral head and the bone of the acetabulum at the time of surgery.

7 Extra articular hip fusion alone will fail, or the ankylosis will be greatly delayed if there is abundant soft tissue in between the femoral head and the acetabulum at the time of surgery. It takes years for new bone trabeculae to penetrate into the avascular fibrocartilaginous tissue and cross the joint space in order to establish solid bony fusion. As much of the interposed fibrous tissue as possible will have to be removed at the time of surgery and the joint packed with bone chips if an arthrodesis is desired in a short time (3, 9).

8 A tuberculous hip joint is not completely immobilized even with a well fitted and extensive plaster cast. The potent adductor muscles tend to pull the thigh constantly into adduction (4). A bone graft applied over the outer aspect of a tuberculous hip joint will be submitted to distracting forces which will bring about atrophy of the graft and even its fracture. An extra articular bone graft over a tuberculous hip joint is usually incapable of stabilizing the hip if there is abundant soft tissue interposed between the femur and acetabulum (Fig. 8). A tuberculous hip is not safe until bone trabeculae cross the joint space.

In order to abolish the action of the adductors on the hip joint we have been performing a subtrochanteric osteotomy at the time of the arthrodesing operation of the hip. After the osteotomy the upper femoral fragment is under the almost exclusive action of the abductors. The denuded femoral head and acetabulum and the bone graft placed in the outer aspect of the joint are then submitted to pres-

sure stresses which stimulate new bone formation resulting in bony fusion (Fig. 12). Several weeks elapse before the osteotomy site becomes solid allowing the adductors to act anew over the hip joint area, but by then bony bridges have already started to form at the hip and the fusion proceeds unhampered. This procedure of combining the subtrochanteric osteotomy with the hip fusion has been used successfully by us in the arthrodesis of painful degenerative osteoarthritic hips and in variably the fusion time has been greatly shortened. Intertrochanteric osteotomy may be used in these cases to eliminate the action of the psoas over the upper fragment, but in tuberculosis a subtrochanteric osteotomy is safer. Metal fixation is unnecessary and in many instances it is harmful to the process of osteogenesis. It must never be employed in tuberculous lesions.

#### TUBERCULOSIS OF THE HIP JOINT IN ADULTS

Nine patients from 23 to 61 years of age with proved tuberculosis of the hip, were seen. There were 6 males and 3 females. Their hip tuberculosis started from 1 to 3 years prior to admission. Both hips were involved in 1 patient. In no instance was a para articular focus of osteitis seen in adults prior to the hip joint invasion.

The evolution of tuberculosis of the hip in adults varied more widely than in children and in many patients it was closely related to the evolution of their pulmonary tuberculosis. We found it convenient to classify the adult patients with bone tuberculosis into three groups.

Group A. Patients with cured or with minimal pulmonary tuberculosis who developed osteoarthritic tuberculosis of the hip of very slow onset with mild hip pain of intermittent character, slight limp, and slowly increasing stiffness of the hip joint. These patients had no tuberculous abscess formation but if one developed it was always small and noninfiltrative. The roentgenograms showed slow progressive thinning of the joint space and moderate destruction of the subchondral bone of the femoral head and acetabulum. The destructive hip process usually became arrested in 2 to 3 years.

There are in the files of this hospital 11 patients who very likely belonged to this group. In only 2 patients was it possible to prove by guinea pig inoculation the tuberculous nature of the lesion and only these 2 patients were included in our series. One was a 23 year old woman with a healed pulmonary tuberculosis who came to our clinic 3 years after onset of the hip symptoms. There was no tuberculous abscess and the roentgenogram showed an arrested hip lesion with very narrow joint space and minimal bone destruction (Fig 13). The other patient was a 54 year old man with a fibrotic tuberculous lesion in the right apex of minimal extent. He was admitted to our service 10 months after onset of hip symptoms. A small cold abscess in Scarpa's triangle was found and the roentgenograms showed marked bone atrophy about the left hip and areas of subchondral bone destruction. An extra articular hip arthrodesis was performed shortly after admission in the first patient and one year after conservative treatment in the second patient. Both hip joints were solidly ankylosed 1 year after surgery.

Group B. Patients with active pulmonary tuberculosis who developed tuberculosis of the hip. Four of our patients belonged to this group: 2 males and 2 females of from 27 to 31 years of age. All these patients had more or less acute onset of sharp pain in the hip with marked limitation of motion. They soon developed large warm tuberculous abscesses. The roentgenograms showed rapid narrowing of the joint space, extreme bone atrophy, and in 2 patients one or two wedge shaped subchondral sequestra were seen (5). The roentgenograms taken in the consecutive months showed that the hip joint seemed to melt away in 3 patients while the other showed bone sclerosis 1 year after onset. All 4 patients died from 1 to 6 years after onset of hip tuberculosis with extensive lung cavities (Fig 14).

At autopsy the hip joint was examined in 1 of these patients. Caseous material filled the cavity. The articular cartilage was absent, the synovia and joint capsule showed a great number of foci of caseous necrosis with minimal tubercle formations. There were areas of caseation necrosis in the bone marrow in the head of the femur and acetabulum. The

wedge-shaped sequestra proved to be formed by dead bone with primary caseous necrosis of all the marrow elements.

The orthopedic treatment for the patients of this group consisted only of immobilization of the leg with traction or hip spica.

Group C. Patients with very destructive osteoarticular tuberculosis, with big abscess collections and no or minimal pulmonary tuberculosis with surprisingly good general condition. Three patients, all males, from 37 to 63 years of age belonged to this group, one with bilateral hip tuberculosis and tuberculosis of the knee. These patients had no, or very low fever. The red blood count was almost normal however the sedimentation rate and the white blood count were elevated. The pain was moderate in character or sharp, aggravated by weight bearing. Large tuberculous abscesses collected in the middle, lateral or posterior aspect of the hip joint. Roentgenograms showed extensive destruction of the femoral head and not so much of the acetabulum. The bone destruction progressed for several years before the process became arrested. Two patients were treated conservatively and have been followed for 5 and 9 years. One is well and there are a few degrees of painless motion in the hip joint; the roentgenograms showed the femoral head reduced to one-third of its size. The process has been arrested now for 2 years and an arthrodesis operation has been advised but it has been refused by the patient. The other patient had the left femoral head completely destroyed before the tuberculosis became arrested 3 years ago (Fig 15). He now has fairly good range of motion in this hip which is unstable. The other hip and one knee became involved 1 and 2 years after the onset of the symptoms in the left hip. His general condition has been good for the past 5 years. A 63 year old man was treated surgically by extra-articular fusion. An abscess was encountered around the hip joint which became infected and drained profusely until the patient died of cerebral thrombosis 3 months after surgery.

The treatment of tuberculosis of the hip in adults must vary according to the stage of the tuberculous process in each special case. The patients with hip lesions described for group

A may be treated by extra articular hip fusion as soon as the general and local tuberculous processes are under control usually from 2 to 3 years after the onset of the hip symptoms. Intra articular fusion in these involved hips is not absolutely necessary because the joint space is very narrow and is easily breached by bone trabeculae after the extra articular graft has become solid. The patients with tuberculous lesions as described in group B must be carefully studied before deciding upon any surgical procedure on the hip, because the hip tuberculosis is but a symptom of a spreading tuberculous process with no tendency to become arrested and surgery in these patients is definitely contraindicated. The patients of group C are better treated conservatively at first and surgery must be delayed until the destructive process becomes arrested. Resection of the upper femoral epiphysis may in the selected cases shorten the healing time. A hip fusion may be technically impossible to perform in many patients of this group when the process is arrested because of the extensive loss of bone substance. A Trumble or a Brittain operation may be the answer but we have had no experience with these procedures.

#### SUMMARY

The evolution and the results of conservative and operative treatments were studied in 31 proved cases of tuberculosis of the hip followed for a minimal period of 4 years.

The patients were divided into 3 groups. The first group comprises 7 patients all children who had a para articular focus of tuberculous osteitis. The roentgenographic and histological characteristics of the two different types of tuberculous osteitis were described. In the granulous osteitis the roentgenograms show a small area of uniform bone destruction whereas one or several small bone sequestra are seen in the area of destruction due to caseous osteitis. Both types of tuberculous osteitis have a tendency to heal under prolonged conservative treatment. However the hip joint in each of the 7 patients was invaded sooner or later by the tuberculous process.

The hip joint was very slowly destroyed when lesions of tuberculous granulation tis-

sue with no caseation predominated. On the other hand the involved hips were destroyed rapidly when lesions of caseation necrosis were widespread in the joint structures. The clinical symptoms in the last group of patients were of acute character whereas in the first group they were mild and chronic. Once the hip joint became involved it either fused spontaneously or a fusion operation had to be performed because of persistent pain and deformity. A Brittain operation performed in 1 patient 5 years after the onset of symptoms failed due to erosion of the graft by a tuberculous abscess.

It is proposed that the treatment of tuberculous osteitis close to the hip joint be directed toward obtaining an ankylosed joint as soon as the local process is quiescent and the general condition of the patient is favorable. No time should be wasted trying to heal the osteitic process by prolonged immobilization, because the hip joint becomes sooner or later involved in the great majority of patients.

The second group comprises 15 patients with tuberculous arthritis of the hip joint with onset during childhood. In 8 patients seen early after the onset of symptoms the tuberculous arthritis was probably of synovial origin. The symptoms and evolution of the tuberculosis of the hip in children were discussed both from the clinical and roentgenologic points of view. It was concluded that the treatment must aim at fusion because only in rare instances is a stable painless and movable joint obtained. Surgery must be delayed until the general condition of the patient is good and the roentgenograms show a sound reossification of the atrophic bone. This 'healing' reaction appeared usually from 1½ to 3 years after onset of hip symptoms if good general and local therapeutic measures were followed. The optimum time for surgery is, thus during the third year of the disease. If surgery is delayed beyond the third year the joint space may increase in width due to overgrowth of fibrous tissue. This overgrowth has to be removed at the time of surgery. The best results of hip fusion were obtained with the intra articular and extra articular methods combined. The author recommends a subtrochanteric osteotomy at the time of sur-



gery in order to abolish for a time the action of the adductors on the upper portion of the femur which submits the bone graft to distracting forces and thus to atrophy.

The third group comprises 9 patients of adult age with hip tuberculosis. Its evolution varied widely and in many patients it was closely related to the evolution of their pulmonary tuberculosis. Some patients had only minimal bone destruction with thinning of the joint space. Their general condition was good and responded well to an extra articular arthrodesis. Other patients, who had active pulmonary tuberculosis, exhibited very extensive and fast destruction of the hip joint and died a few years after the onset of the hip involvement. Other patients had very destructive osteoarticular tuberculosis with abscesses but with good general condition. The process

lasted for a long time and when arrested the hip was very unstable.

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# PORTACAVAL ANASTOMOSIS

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THE portacaval shunt as an efficient means of ameliorating portal hypertension opens up a broad field of usefulness. It was heartening in our early cases to find that patients tolerated the operation amazingly well, also that despite the fact that a number were bad risk patients only 5 in a series of 40 patients in whom portacaval shunts were completed failed to recover from the operation.

Although the portacaval shunt operation has been employed by us primarily to eliminate the threat of lethal hemorrhage in cases of portal hypertension, we have found that the concomitant relief of ascites when present has been effected.

A discussion of some of the causes of portal hypertension in terms of indications for the portacaval shunt follows.

**Schistosomiasis.** We consider the portacaval shunt operation as the one great hope in cases of schistosomiasis of the liver. This is a disease that, in some part of the world, accounts for a good percentage of hospital admissions. From the natural history and pathology of the disease it is now well known that the patient dies from complications of portal hypertension rather than from damage to liver cells. From the point of view of liver function the cases are excellent operative risks. Portacaval shunt should protect them against lethal hemorrhage and assure the relief of ascites which in this disease is primarily the result of portal hypertension. We can report one case with an excellent postoperative result.

**Chiari syndrome.** Our experience with Chiari syndrome (thrombosis of the hepatic veins) is limited to one case. The outstanding findings in this case was the presence of a very large liver, a spleen several times larger than normal, ascites and a moderately elevated

portal pressure upon measurement. Edema of the legs and a tendency to recurring pleural effusions was an additional unexplained finding in this case. The liver biopsy revealed extreme congestion with apparent widespread liver cell damage but strangely enough aside from a slight depression of serum albumin the liver function tests were but slightly if any deranged. A marked immediate improvement in the ascites followed the establishment of a splenorenal shunt in this case but, the persistence of some ascites marked leg edema and pleural fluid in the right chest constituted a problem. Finally with the institution of sodium lactate therapy, there was a marked response from diuresis and after the lapse of three weeks the edema had completely disappeared. (1) Now 1½ years since operation aside from a tendency to anemia, the patient's general condition has markedly improved. Her liver function studies are normal and the organ has returned to almost normal size. For the past 9 months she has worked as a secretary to the United Nations and states that by comparison her health is now robust.

Chiari syndrome is reputedly a serious condition from which patients do not recover. This patient after a 1½ year follow up is apparently recovering.

**Banti's syndrome.** A common cause of portal hypertension in this country is Banti's syndrome. Patients so afflicted and showing esophageal varices or presenting a history of gastrointestinal bleeding are unequivocally candidates for the portacaval shunt. Those patients with Banti's syndrome who have essentially normal liver chemistry are unusually good operative risks for the portacaval shunt operation; those having cirrhosis require special handling.

**Cirrhosis of the liver and portal hypertension.** It has long been recognized that portal hypertension of varying degrees develops some time during the course of the disease in the common types of cirrhosis of the liver. The association of portal hypertension with the occurrence of

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hemorrhage and ascites in cirrhosis has like wise been long accepted as fact.

Whereas the fact remains that portal hypertension is the common basic cause of severe gastrointestinal hemorrhage in cirrhotics more recently prothrombin derangement as it affects blood clotting has been accepted as a co-factor in inciting or prolonging hemorrhage under certain conditions. Similarly the relationship of the blood proteins, particularly the albumin content as a factor in ascites is better understood.

Prothrombin derangement (deficiency) may be the result of two causes (1) failure to absorb vitamin K (2) inability of the liver to make adequate amounts of prothrombin. The former occurs in conditions effecting biliary obstruction in which the triad of jaundice, acholic stools, and a high alkaline phosphatase are familiar. The latter occurs in serious decompensation of the liver.

Since progress has been made in recent years in the medical treatment particularly of Laennec's (portal) cirrhosis, it is pertinent to discuss its possible influence on the problem of hemorrhage.

Dr Arthur Patek (2) tells me that in his series of 124 treated patients the incidence of hematemesis was 33 per cent (42 cases). This compared with an incidence of 27.4 per cent reported by the same author (3) for a series of 386 untreated patients with cirrhosis indicates that the modern regimen has not reduced the incidence of hematemesis. Though one could not expect to affect favorably the portal hypertensive component in hemorrhage by a medical regimen it was hoped that improvement in the prothrombin component (as has certainly been demonstrated in many cases) would remove what would prove to be an important inciting factor and thus reflect a lowered incidence of hematemesis.

The above comparative statistics, when coupled with the finding that ruptured esophageal varix was recorded as the cause of death in 100 patients (16 per cent) of 386 cases of cirrhosis (3) may be interpreted to indicate that portal hypertension rather than the prothrombin derangement component is the important factor in the cause of lethal hematemesis.

Whereas the incidence of hematemesis has not apparently been reduced following the introduction of the modern medical regimen for the treatment of Laennec's cirrhosis, the likelihood of a patient surviving an individual attack of hematemesis has improved. Credit for this may in large part, be due to more ready availability of transfusions through the development of blood banks. However we again refer to the results in Dr Patek's series of treated patients where we note, under optimum treatment conditions, that 22 of the 44 patients having hematemesis died. One half of the patients died within 1 year of the onset of their first hemorrhage.

A realistic appreciation of the figures given makes it imperative that those of us responsible for the care of patients with cirrhosis recognize our obligation to protect the patient from lethal hemorrhage.

Fortunately we now have adequate evidence that a portacaval anastomosis, either of the splenorenal or the portal vein to vena cava type will protect patients against the recurrence of severe gastrointestinal hemorrhage. The efficiency of the anastomosis in lowering the portal blood pressure thus preventing the occurrence of hemorrhage has been recorded and observed by us in patients again and again. The portacaval shunt operation has been accomplished by us forty times with an operative mortality of 12½ per cent. In view of these facts, we consider the procedure no longer an experimental operation but commend its consideration in cases of cirrhosis when patients have had one or more episodes of gastrointestinal hemorrhage—patients who when treated medically under the best of circumstances have only a 50 per cent chance of living.

**Ascites.** Although ascites regularly disappeared following the portacaval shunt operation when done in cirrhosis cases for the control of hemorrhage we do not consider ascites as a primary indication for the operation.

The outstanding achievement of the modern liver regimen in the treatment of Laennec's cirrhosis of the liver has been the relief of ascites. The relief of ascites occurs *pari passu* with improvement of liver function particularly in respect to a rise in the blood albumin.

Failure to clear ascites following a vigorous and prolonged treatment regimen is usually due either to failure to regain liver compensation in the presence of a too severely damaged liver or to the presence of excessive portal hypertension. The latter cause may be strongly suspected in patients whose blood albumin level is in excess of 3 per cent and essentially confirmed if roentgenograms demonstrate the presence of esophageal varices. We recommend portacaval shunt in this latter group of treatment failures for the following reasons: (1) The demonstration of esophageal varices in such cases is proof of the existence of a severe grade of portal hypertension which in itself constitutes a serious threat of sudden death from hemorrhage. (2) If this group of medical treatment failures are allowed to go on indefinitely with repeated paracenteses they eventually die of wasting ascites. (3) They are over all good operative risks. The liver is usually excellently compensated. The organ may be capable of maintaining an albumin blood level well in excess of 3 per cent were there not too much albumin loss through the removal of excessive amounts of ascitic fluid. Such patients are among our most grateful ones.

We hope in the near future to assemble our data in cirrhosis cases so that we may com-

pare the albumin blood level with ascites in the presence of different degrees of portal hypertension as measured at the operating table before and after the establishment of portacaval shunts. The frequently observed fact that ascites will appear in the average cirrhotic when the blood albumin approaches 3 per cent whereas tissue edema does not appear until a considerably lower level is reached may be taken as *prima facie* evidence that a portal hypertensive component is involved to the formation of ascites.

*Posthepatitis cirrhosis.* Posthepatitis cirrhosis is a disease seen all too frequently these days. When the disease has reached the stage of causing demonstrable varices with or without a history of bleeding if the liver function is yet reasonably good we recommend the establishment of a portacaval shunt. We have gathered the impression that when the disease has reached this stage the modern liver regimen affects little if any its downhill course and there is extreme likelihood of seriously persistent bleeding.

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# THE PHYSIOLOGY OF FECAL CONTINENCE

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**S**TUDIES of the distal colon and anal sphincters in animals as reported by several investigators, have been fairly uniform in showing a functional relationship of one to the other. Similar studies in man while less numerous, have been mainly concerned with changes resulting from various nerve lesions. The purpose of this communication is to report the results of a study of the mechanism of fecal continence in normal adults. This mechanism is of particular importance to surgeons who within recent years have taken a renewed interest in sphincter preservation in resections of the rectum for cancer.

## DEFINITION OF FECAL CONTINENCE

Fecal continence the ability to retain feces until its delivery is convenient is of two types: colonic and sphincteric. Colonic continence depends on the plastic adaptation of the smooth muscle of the colon to the enlarging fecal mass. Its usefulness in the normal adult is evident in the practically constant finding by x ray and sigmoidoscopy of fecal material collected in the sigmoid above an empty rectum without the aid of an anatomically demonstrable sphincter at the rectosigmoid junction. It is this type of continence which is retained by the patient with well managed abdominal colostomy and its full utilization makes colostomy a bearable deformity. It is entirely under the control of the autonomic nervous system and may be responsible for some of the functional results reported by those who favor sphincter preservation.

Sphincteric continence implies the retention of bowel contents by sphincteric contraction when the plastic adaptation of the colon reaches an end and peristalsis begins. That

sphincteric continence is not a simple peristaltic effect but a complicated and highly integrated mechanism will be shown in the studies presented here.

## THE SPHINCTERIC APPARATUS

While it is not the purpose of this communication to deal extensively with the anatomy of the sphincteric apparatus, several points which bear on the experimental findings to be reported should be clarified. The internal sphincter a collection of smooth muscle fibers surrounding upper portion of the anal canal is a continuation of the circular muscle of the distal part of the rectum. It is entirely under the control of the autonomic nervous system.

The external anal sphincter is composed of striated muscle under the control of the voluntary nervous system. It is variously described as consisting of two (9, 11, 15, 29, 35) or three (32) separate muscle bundles. With the anal canal closed the superficial portion of the external sphincter lies distal to the internal sphincter while the deeper portion partially overlaps it. With the anal canal dilated by the presence of a fecal mass or as in the experiments to be described by the presence of an obturator the two sphincters come to occupy a more truly internal and external position (11) although some overlap remains. These facts make it possible to secure graphs representing the function of each sphincter separately but only to a relative degree. A graph representing the function of one sphincter will necessarily have some components of the other superimposed on it. Sufficiently clear tracings can be obtained, however to indicate the function of each.

The external sphincter is made up of striated muscle which differs from that in other parts of the body in its reaction to denervation. Goltz and Ewald found that it remained reactive to electrical stimulation for long periods after the removal of the lumbar and sacral portions of the spinal cord in dogs. In animals

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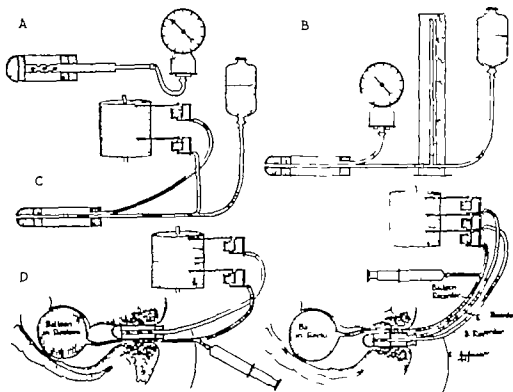


Fig. 1. Methods used for studying the mechanism of fecal continence. A, (method I) a simple manometric apparatus for recording the strength of voluntary sphincter contractions. B, (method II) for obtaining simultaneous readings of colonic and sphincteric activity (colo-sphincto-metrogram) later adapted to kymographic recording as in C, (method III). D, (method IV) for recording the effects of rectal stimulation on the anal sphincters. E, (method V) similar to D except that the activity of the internal and external sphincters are recorded independently and simultaneously.

poisoned with curare von Frankl Hochwart and Froelich found the external sphincter to react to stimulation long after other skeletal muscles had ceased to react, findings which have been only partially substantiated by the more recent work of Learmonth and Markowitz (27). Arloug and Chantre showed that there were no microscopic changes in the external sphincter 11 months after destruction of its nerve supply. Because of these findings the external sphincter 'has been conceived to possess nerve centers similar to those of the myenteric plexus of Auerbach' (24), a point that has been recently confirmed microscopically by Reuther.

The part played by the levator ani muscles in the maintenance of sphincteric continence is difficult to evaluate. They have been described both as dilators of the anal canal and as having a sphincteric function (32-34). Since these muscles have fibers running both radially and parallel to the anal canal it is probable both views are at least partially correct.

## METHODS OF STUDY AND RESULTS

### Method I

The first method of study consisted of a simple apparatus for measuring the strength of the voluntary contraction of the external anal sphincter. A cylinder of light rubber was fastened between the ends of an obturator 1 inch in diameter. The obturator was connected by heavy small bore rubber tubing to a blood pressure aneroid (Fig. 1 A). The obturator was inserted with the soft rubber cylinder encircled by the anal canal. After the initial irritability of the sphincter caused by the insertion had subsided and the pressure due to the basic tonus noted, the patient was requested to close the sphincter with all possible force. The difference between the basic tonus and the greatest force exerted by the sphincter was used as an index of the strength of the voluntary sphincter. Table I shows the net increase of tonus during voluntary contraction of the anal sphincter in the 41 normal subjects examined by this method. These tests indicated

TABLE I—MAXIMUM FORCE EXERTED ABOVE  
BASIC TONUS DURING VOLUNTARY SPHINCTERIC  
CONTRACTION IN CONTINENT SUBJECTS

Max mercury	No cases	Per cent
10 or less		9
10 to 20	3	3.7
21 to 30		3.7
31 to 40	1	
41 to 50		7
51 to 60	3	7.3
61 or over		4
Total	4	100

that the force exerted by the contracting sphincter could be maintained for only a very short time and furthermore that the strength of the voluntary sphincter contraction bore no apparent relation to sphincteric continence. Thus the maximum force of contraction varied from 9 millimeters of mercury in a 72 year old woman to 240 millimeters of mercury in a 45 year old man yet both had perfect sphincteric control of gas and feces.

### Methods II and III

These observations led to efforts to adapt the colonmetrogram described by White Verlot and Ehrenthel to the solution of this problem. A second somewhat smaller obturator covered by a cylinder of soft rubber was constructed. The air space thus enclosed was connected to a blood pressure aneroid which was again used to indicate the pressure exerted by the contracting sphincter. The hollow center of the obturator was connected with a reservoir bottle containing water at approximately body temperature by means of which an enema could be given. A vertical glass manometer with the zero point at the level of the anus was connected between the obturator and the reservoir. Increments of 100 cubic centimeters or 200 cubic centimeters of water were allowed to run into the colon at a constant rate of approximately 100 cubic centimeters per minute after which the tube leading from the reservoir bottle was clamped and pressure readings on both manometers made (Fig. 1 B). The rapid fluctuations of colon and sphincter pressures made it impossible to

secure accurate simultaneous readings, and the method was therefore adapted to kymographic recording (Fig. 1 C). With the kymographic method the fall-away bellows, timbours and connecting tubes were filled with water to obviate errors that would otherwise occur from the compressibility of long columns of air. Electric recording (30) was found to be safe, clean and to require a minimum of friction between the writing point and the drum.

The kymographically recorded combined colonmetrogram and sphinctermetrogram (colo-sphinctermetrogram) was obtained on 1 normal adults. Measurements of the kymographic tracings were used to construct summary charts of which Figure 2 is an example. The lower line marked "A," is that of a normal colonmetrogram as described by White and associates. That is the lowest colonic pressure recorded between increments of injected water was used to construct the base line. The vertical dotted lines extending upward from the base line indicate the maximum pressure recorded in this interval between injections, and represent the efforts of the colon to empty itself by peristalsis. The central shaded area marked "B" represents the activity of the colon during the injection of each increment. The pressure of the fluid injection (height of fluid in reservoir) was kept at a constant level (30 cm. in Fig. 2). As soon as each injection was started the needle recording colonic pressure immediately jumped to a point indicating a pressure of from 30 to 40 centimeters of water. This was followed by waves of increased pressure indicating colonic contractions which tended to resist the injection of each increment. These waves of colon resistance were usually accompanied by an increased desire to empty the colon. The subjective limit of tolerance to colon filling by retrograde injection is usually about 2000 cubic centimeters. It was noted that up to a volume of 600 or 800 cubic centimeters the injection of each increment was accompanied by a subjective desire to defecate and at the same time by evidence of peristaltic activity in resisting the injection. In about the middle third of the enema, that is from 600 or 800 to 1200 or 1400 cubic centimeters each increment was attended with little or no peristaltic activity in resisting the

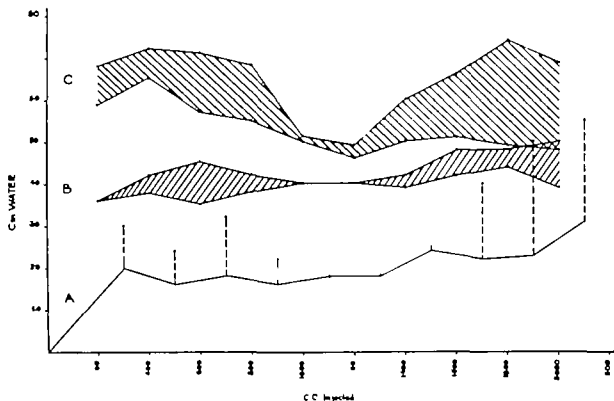


Fig 2 The colo-sphincto-metrogram in a normal adult A Shows the activity of the colon in centimeters of water pressure following the injection of 100 cubic centimeter increments of water per anum. B, Shows the activity of the colon during the injections, and C, the activity of the sphincter during the injections.

injection while during the injection of the last increments peristalsis again became active

The activity of the sphincteric mechanism during the injection of each increment is indicated in the shaded area marked 'C' which is bounded by points indicating the lowest and highest sphincter pressures recorded during each injection. The similarity of sphincter activity and colon activity during the injection is evident. Thus during the first third of the enema both the colon and sphincter are quite active. This activity diminishes during the middle third but increases again in the latter part of the enema. This correlation of sphincteric activity to changes in colonic pressure is also illustrated in Figure 3, made after the colon had been filled to the limit of toleration. The waves of increased colonic pressure (C.P) corresponding to peristaltic waves are associated with simultaneous increases of sphincter tone (S.P). This correlation indicates that the sphincter responds by closing the anal canal only as the necessity for resistance to the propulsive peristaltic activity of the colon becomes necessary

The necessity for this close correlation between peristaltic and sphincteric activity is evident from a study of the fatigue curves produced by voluntary sphincter contraction. These curves were obtained by placing the obturator across the entire anal canal so that the resultant of all components of the sphincteric apparatus was recorded. After the sphincteric activity resulting from the insertion of the obturator had subsided the patient was requested to contract the sphincter with all possible force and for as long a time as possible. Figure 4 illustrates typical fatigue curves. The initial contraction brought a rapid rise of sphincter pressure of but momentary duration and was followed by an irregular but progressive fall to the base line. Figure 4 A represents two separate voluntary sphincter contractions. At X in Figure 4 B the patient was urged to continue the contraction with all possible vigor and this encouragement resulted in some increased activity followed by a fall of pressure which paralleled that following the initial effort. Table II shows the maximum pressure exerted by the



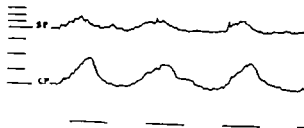


Fig. 3. Colon pressure, C.P. and sphincter pressure, S.P. recorded simultaneously after the colon had been filled with water to the limit of toleration. Time line equals 30 seconds.

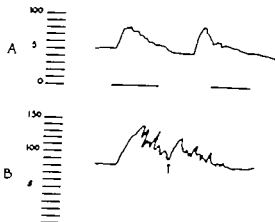


Fig. 4. Fatigue curves of voluntary sphincter contractions. Time line equals 30 seconds. Pressure scales in centimeters of water.

voluntarily contracted anus as well as the time during which there was any sphincteric activity however slight. An average maximum contraction of 44 centimeters of water pressure and an average duration of 52 seconds gives some indication of the fatigue curve of the normal voluntary sphincter. Introspection confirms the rapidity with which the voluntarily contracted sphincter fatigues and emphasizes again the necessity for correlation of sphincter tone to bowel activity in the maintenance of sphincteric continence.

#### Method IV

In an effort to evaluate the effects of local stimulation of the lower sigmoid colon and rectum on the sphincteric apparatus as well as to differentiate the functions of the internal

TABLE II.—ANALYSIS OF SPHINCTERIC FATIGUE CURVES IN NORMAL SUBJECTS

Age	Sex	Maximum contraction in cm. H <sub>2</sub> O	Maximum duration in seconds
	F	30	90
	M	5	18
18	F	7	65
20	M	30	40
20	M	27	40
26	F	33	30
23	F	30	60
28	F	60	70
30	M	44	45
32	M	30	33
34	F	33	33
36	F	38	40
70	M	44	81
Average		44 cm.	52 sec.

and external sphincters, the apparatus diagrammed in Figure 1 D was constructed. This consisted of a rubber balloon cemented to a graduated urethral catheter. The balloon was introduced into the sigmoid with the aid of a sigmoidoscope or into the rectum by digital manipulation. The end of the catheter was connected by a glass "T" tube to a 50 cubic centimeter syringe and a recording tambour. The balloon was distended with water by means of the syringe and pressure changes during and after filling were recorded kymographically. A small metal obturator was covered with a pliable rubber cylinder. The enclosed space was connected to a recording tambour and the system filled with water. By placing the obturator across the entire anal canal the combined activity of both sphincters was recorded while by moving the obturator further in or pulling it partially out of the anal canal fairly pure recordings of the pressure exerted by the internal or external sphincter could be obtained. The small catheter traversing the anal canal beside the obturator did not materially affect the recording of changes of sphincter tone.

The sensation resulting from distention of the balloon in various portions of the sigmoid and rectum was found to conform to the findings of Hertz. Distention of the balloon with 100 to 200 cubic centimeters of water when placed above the rectosigmoid junction (18 to 22 cm. above the anus) caused a pressure sensation which was referred to the lower abdo-

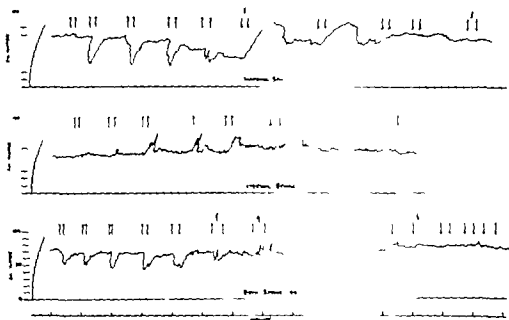


Fig. 5. The response of A, the internal sphincter B the external sphincter and C, both sphincters to the stimulus of a distended balloon placed in the rectum 10 centimeters above the anus. Arrows pointing upward indicate 50 cubic centimeter increments of filling. Downward arrows indicate 50 cubic centimeter decrements of emptying.

men usually in the midline but at times in the left lower quadrant. Similar distention of the balloon placed just below the rectosigmoid junction (15 cm. above the anus) gave rise to a desire to defecate which was localized in the sacral and posterior perineal regions. As the balloon was moved closer to the anus the same amount of distention caused progressively increasing sacral or perineal sensations. It is probably a matter of practical importance that the anal reflexes (to be described) which result from stimulating the rectum by distention of the balloon similarly vary in intensity according to the area of application of the stimulus. Thus with the balloon in the sigmoid little or no reflex activity results. The responses progressively increase as the stimulating balloon is placed closer to the anus.

Since the anal reflexes occurring in response to distention of the balloon varied with its location, all tests were carried out with the center of the balloon at a constant level of 10 centimeters above the anus. Contrary to the findings of Garry (18) sufficient distention of the balloon was found to be an adequate stimulus for the production of the rectoanal reflexes. After numerous trials it was found that filling the balloon to 250 cubic centimeters by means of five increments of 50 cubic centimeters each gave responses that were

consistent in different individuals and in different tests on the same individual. The tests were most satisfactory when done within a few hours after a normal evacuation.

**Results** The response of the internal sphincter to the stimulus of a distended balloon in the rectum was obtained by moving the obturator into the anus until only its proximal half was recording while its distal half protruded into the cavity of the rectum. When the obturator was placed across the entire anal canal, the kymographic tracing consisted of an irregular line with many sharp peaks and valleys representing minor but very rapid changes in muscle tone changes characteristic of striated muscle. As the obturator was inserted further there was frequently an abrupt change in the character of the tracing which showed fewer and much slower changes in tone, giving rounded curves characteristic of smooth muscle contractions. Occasional sharp peaks of striated muscle contraction were noted at times indicating partial overlapping of the internal sphincter by the external.

By careful attention to details it is possible to secure a response characteristic of the internal sphincter in nearly all normal adults. The characteristic internal sphincter response is shown in Figure 5 A. With the first increment of 50 cubic centimeters there may or

may not be a change of sphincter tone. Invariably with the second and succeeding increments following a short latent period, there is a rapid but smooth fall of sphincter tone represented by a dip of greater or lesser magnitude in the graph line. After the first such fall the tonus usually returns promptly to its former level but with each succeeding increment the tonus fails to return to its former level and after five or more increments the tonus is invariably appreciably lower than it was when the test was started. Since the external sphincter overlaps the internal and since as will be shown the external sphincter tonus is rising while the internal is falling with the last increments of the test there are frequently superimposed sharp momentary rises of pressure ( $e$  in Fig. 5 A).

On withdrawal of 50 cubic centimeters from the distended balloon there is a prompt rise of internal sphincter tonus which at times momentarily exceeds the initial tonus, but returns to the initial level after about 1 minute. The second withdrawal may be accompanied by a similar response but succeeding withdrawals are usually not accompanied by significant changes in internal sphincter tonus.

The characteristic response of the external sphincter is shown in Figure 5 B. Thus is obtained by withdrawing the obturator until its proximal half protrudes beyond the anal verge while its distal half is gripped by the external sphincter. It will be noted that the graph line is characteristically different from that of the internal sphincter the line being roughly irregular with numerous sharp peaks and valleys representing the rapid change of tonus characteristic of striated muscle.

With the first two increments there is a slight but definite rise of sphincter tonus. With the third, fourth, and fifth increments there are sharp rises of sphincter tonus which return to the preinjection level soon after the injections are completed.

This contraction response of the external anal sphincter was always obtained when the patient was instructed to make voluntary efforts at fecal retention as the subjective urge to defecate increased with each succeeding increment. When the patient was instructed to relax and not consciously resist the urge to

defecate, the response was frequently but not invariably obtained. Co-operation in this matter was difficult to evaluate. Even when the contraction response was not obtained there was no fall of external sphincter tonus such as was seen with the internal sphincter.

*The combined response of both sphincters.* With the above background concerning the independent action of the internal and external sphincters it is evident that in individuals willing fecal retention, the stimulus of a rapidly distended balloon in the rectum will cause changes in the tonus of the entire sphincteric mechanism which are the resultant of two forces: dilatation of the internal sphincter and contraction of the external sphincter. With the obturator placed across the entire anal canal the graph of sphincter pressure shows changes characteristic of either sphincter depending on which is dominant and, most commonly the changes characteristic of both sphincters can be discerned. In the latter instance the first few increments are frequently associated with a fall of sphincter pressure characteristic of the internal sphincter. As the balloon enlarges with succeeding increments and the urge to defecate reaches the level of consciousness and then becomes imperative, the character of the response changes to that of the external sphincter (Fig. 5 C). It is of some interest that the internal sphincter response is nearly always obtained with the first increments of filling often when the patient has no conscious awareness of a rectal sensation while the external sphincter response is often not obtained until rectal sensation is present. In some individuals the external sphincter is dominant throughout the test as in Figure 6 A while in others the early increments cause no change in pressure probably because the effects of the two sphincters cancel each other while the later increments show an external sphincter dominance (Fig. 6 B).

Denny Brown and Robertson have shown in human beings that the internal sphincter reflex returns after the period of the spinal shock has passed not only when the lumbar and thoracic portions of the spinal cord have been transected, but also following complete destruction of the sacral cord. Figures 6, C and 6 D are the responses obtained in an 18

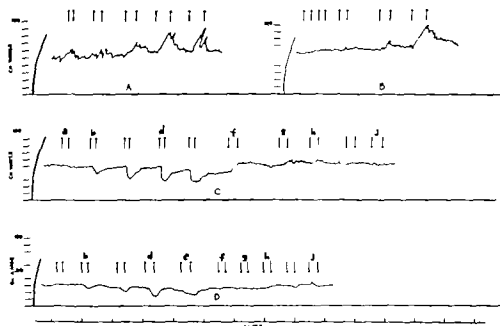


Fig. 6. A and B. The response of the entire sphincteric apparatus to the distention of a balloon in the rectum, 10 centimeters above the anus, in normal individuals. C, The response of the entire sphincteric apparatus to filling and emptying of a balloon in the rectum 10 centimeters above the anus in a patient with transection of the spinal cord. D. Same as C but with the obturator placed across only the external sphincter. In all graphs arrows pointing upward indicate 50 cubic centimeter increments of filling of the balloon. Downward arrows indicate 50 cubic centimeter decrements of emptying.

year old female who suffered a complete transection of the spinal cord from a compression fracture of the eighth thoracic vertebra 14 months before the tests were done. With the obturator across the entire anal canal (Fig. 6 C) the response is similar to the internal sphincter response of a normal individual. With the obturator across only the external sphincter (Fig. 6 D) the response is still that of the internal sphincter although of lessened magnitude because there is less fluid displacement from the obturator which is now being compressed over only half of its surface. The internal sphincter response in this patient confirms the findings of Denny Brown and Robertson in patients with transection of the spinal cord. With transection of the spinal cord the normal internal sphincter response together with the absence of an external sphincter response indicates that (1) cerebral connections are necessary for the execution of the external sphincter reflex although whether these connections must be made at the conscious level is not clear and (2) the internal sphincter response is independent of cerebral connections.

#### Method V

Proof that the curves described above represent respectively the function of the internal and external sphincters is seen in the results of experiments done with the apparatus shown in Figure 1 E. With this method tests were conducted in exactly the same fashion as described for method IV except that a metal septum was fixed in the middle of the obturator dividing it into distal and proximal compartments. Each compartment was connected for independent kymographic recording. With the metal septum placed at about the midpoint of the anal canal it was possible to record simultaneously the separate responses of the internal and external sphincters.

Figure 7 illustrates the effects of stimulation of the rectum on each of the sphincters recorded simultaneously. With each increment of filling of the balloon there is a rise of external sphincter pressure which falls to the base line soon after the injection is completed. As the balloon becomes more distended and conscious rectal sensation (which in this instance started at 80 c.c.) becomes more marked, the elevation of external sphincter pressure with

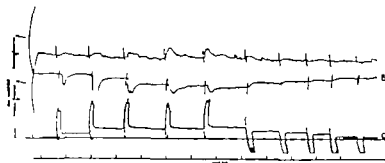


Fig. 7 The responses of A, the external sphincter and B, the internal sphincter resulting from filling and emptying a balloon placed in the rectum centimeters above the anus in normal individual. Line C shows 50 cubic centimeter increments of filling ( $i$  to  $j''$  inclusive) followed by similar decrements of emptying ( $j''$  to  $j'''$  inclusive)

each succeeding increment is higher and lasts somewhat longer. No constant effect on the external sphincter is noted with emptying of the balloon. At the same time that the external sphincter pressure is rising the internal sphincter pressure is falling. Following the first increase of balloon volume the internal sphincter pressure returns promptly to its pre-injection level. Following the second and succeeding increments, however, it does not return to the pre-injection level so that there is a progressive fall. With each reduction of volume of the balloon there is a rise of internal sphincter pressure which after the balloon is empty regains its original level.

Voluntary increase of rectal pressure as by straining to evacuate causes a fall of internal sphincter pressure similar to that accompanying distention of the balloon. Usually such an effort is accompanied by a rise of external sphincter pressure as shown at  $b$  in Figure 8 A. It is difficult to secure satisfactory co-operation of the patient in voluntary straining to defecate because of fear of embarrassment and this almost certainly accounts for the rise of external sphincter pressure noted under these circumstances. Figure 8 B  $b$  a tracing made with the single obturator across both sphincters, shows relaxation of the entire sphincter mechanism on straining to defecate. As the pressure falls, small jerky waves of contraction characteristic of the external sphincter are noted. During reflex increases of intra-abdominal pressure such as during coughing or sneezing the external sphincter contracts with such speed and vigor that no internal sphinc-

ter relaxation is recorded ( $a$  and  $a'$  in Figures 8 A and 8 B)

#### DISCUSSION

The findings described here indicate that in normal individuals anal continence is the result of a fine co-ordination between the rectum and the external anal sphincter. This co-ordination is mediated through reflexes involving both the autonomic and somatic nervous systems and initiated by impulses which arise in the wall of the rectum. The receptor mechanism may lie within the mucosa of the rectum, since the reflexes are abolished by the application of cocaine to the rectal mucosa (18), but more likely lies within the muscular wall, a point that requires further elucidation. Since the rectoanal reflexes become progressively more active the more distally the rectal stimulus is applied it is probable that the receptor units, while present over entire length of rectum, increase in number from above downward and are most numerous in that part of the rectum which lies immediately above the anal canal.

Afferent fibers arising in the wall of the rectum probably normally communicate through the spinal cord with efferent fibers innervating the internal anal sphincter since its reflex is abolished during periods of spinal shock. This reflex arc is independent of cerebral centers since it is not abolished when the spinal cord is transected in the lower dorsal region. Since it eventually returns after destruction of the sacral cord in man (12) and following resection of the spinal cord in experimental animals



importance and will be made the subject of a future communication.

#### SUMMARY AND CONCLUSIONS

1 Fecal continence may be conveniently classified as

a. Colonic continence, which depends on the plastic adaptation of the colon to the enlarging fecal mass. This is retained by patients with abdominal colostomy as well as by those in whom the sphincters have been preserved following resections of the rectum

b Sphincteric continence a term which indicates the active contraction of the anal sphincters which thereby resist the propulsive force of colonic peristalsis

2 Pertinent facts relative to the anatomy of the sphincteric apparatus are reviewed

3 Five methods designed for the study of the sphincteric apparatus are presented.

4 The results of a study of the physiology of the sphincteric apparatus by these methods indicate that

a. Stimulation of the rectum causes the internal sphincter to dilate and to thereby prepare the way for evacuation

b The internal sphincter plays no part in sphincteric continence. Only the external anal sphincter and rectum are concerned with sphincteric continence

c Sphincteric continence is not a simple pursestring effect. The actively contracted external anal sphincter rapidly becomes fatigued because of this its activity must be delicately correlated to colonic activity

d The correlation of sphincteric to colonic activity is mediated through a nervous reflex. The afferent fibers of this reflex arise in the wall of the rectum and communicate with efferent fibers terminating in the external sphincter. The connection between afferent and efferent fibers takes place at cerebral levels.

e The rectum itself must be considered an integral part of the sphincteric apparatus.

5 Sphincteric continence may be lost under the following circumstances

a. Complete division of the external sphincter

b Transection of the spinal cord

c. Surgical injury of the efferent fibers in the external sphincter (inferior hemorrhoidal nerves)

d Removal of the afferent fibers of the rectoanal reflex by resection of all of the rectum

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# SURGERY IN BLEEDING PEPTIC ULCER

## Urgent Operation and the Principle of Exclusion

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THE purpose of this report is twofold first, to examine the need for surgery during the active bleeding stage of bleeding peptic ulcer and second if such a need is established to describe a program for handling these patients. The program has as its two main features urgent operation in selected cases and the exclusion of the ulcer when such an ulcer is technically difficult or hazardous to remove. These principles have been advocated by Finsterer (15) by Allen (3) by Gray and Sharpe by Ameline and Gilbert, and by others. By defining a program based on these principles and by illustrating it with individual case reports we hope to accomplish a further clarification of the fundamental issues involved.

During the year July 1, 1946 to June 30, 1947 219 patients with a diagnosis of peptic ulcer were discharged from the Veterans Hospital West Roxbury 54 of whom either entered with the symptoms of hemorrhage or developed it after admission. Our experience with these patients forms the basis of the report.

### THE NEED FOR SURGERY IN BLEEDING ULCER

A study of the literature leads one to the conclusion that reports on the frequency of hemorrhage in peptic ulcer in order to be informative, must be qualified by descriptions not only of the severity of the hemorrhage considered but also of the total cases studied. Thus we find in the literature (2, 4, 18, 19, 26, 27, 29, 30) that among hospital admissions for ulcer hemorrhage of any degree is reported as ranging between 11 per cent and 40 per cent of the cases. The incidence in our series was 24.6 per cent. In this same group, massive hem-

orrhage (entailing anemia below 3,000,000 red blood cells per cu mm) was recorded in the literature as between 9 per cent and 18 per cent of cases the incidence in our series being 13.2 per cent. Furthermore if one considers as Stolte did a group of patients other than those admitted to hospitals for example all patients in the population suffering from peptic ulcer one finds that the reported incidence of hemorrhage of any degree is 56 per cent.

To be significant then a reported mortality rate in bleeding ulcer cases must be qualified by clearly showing whether the group considered is made up of patients with hemorrhage of any degree or only those with massive hemorrhage. The wide range of mortality as reported in the literature (2, 9, 10, 15, 18, 19, 23, 25, 27, 29, 30) namely 3 per cent to 25 per cent, is largely explicable on this basis. In discussing surgical mortality it is vital to know not only the degree of hemorrhage but at what time during the course of bleeding the operation was undertaken. The varying mortality rates following surgery for bleeding peptic ulcer (1, 7, 15, 16, 17, 19, 23, 28) which range from 4.1 per cent to 42.8 per cent seem after careful scrutiny of the reports to be explicable solely on the varying degrees of exsanguination of the patients at the time of surgery.

The greater seriousness of massive hemorrhage from peptic ulcer in patients past middle life has been testified to by many. Reports in the literature state that between 20 per cent and 33.3 per cent of such patients will die and that of all deaths from hemorrhage in ulcer patients 95 per cent are in this older age group (2, 6, 23, 29).

In summary, it can be stated that approximately 50 per cent of peptic ulcers bleed to some degree during the patient's life that 25 per cent of hospital admissions for peptic ulcer have bleeding as one of the admission symptoms and that approximately 10 per cent of

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TABLE I.—TYPES OF OPERATION FOR BLEEDING ULCER

1. Posterior gastroenterostomy (Mikulicz)
  2. Posterior gastroenterostomy with ligature of the pylorus (Finsterer)
  3. Above procedures plus tamponade of the duodenum (Finsterer)
  4. Ligation of pancreaticoduodenal artery plus direct ligation of the ulcer (Allen)
  5. Excision of ulcer (Finsterer Heuer)
  6. Exclusion operation (Devine Finsterer Gray and Sharpe Allen)
- Subtotal gastric resection with excision or exclusion of the ulcer (Finsterer Allen Walters and Cleveland, Heuer)

all such admissions have massive hemorrhage. The mortality in all patients who are admitted for massive hemorrhage and treated by conservative methods is between 5 per cent and 10 per cent. In the older patients this figure may rise as high as 33.3 per cent. The mortality following surgery for bleeding ulcer may be below 5 per cent if patients operated upon at an elective time are included in the group but it has approached 50 per cent if one considers only those in a state of exsanguination and on whom surgery followed a prolonged and unsuccessful attempt at conservative management.

Under current methods of conservative treatment therefore one or two of every 20 patients admitted with massive hemorrhage from peptic ulcer will die. These patients are almost invariably in the older age group. It is they who establish a need for surgery in the treatment of bleeding peptic ulcer.

#### SURGICAL MANAGEMENT

*A Urgent operation* Since the mortality following surgery seems to be directly dependent upon the degree of exsanguination of the patient at the time of operation we have found it useful to separate operations done during different phases of exsanguination into three categories namely emergency urgent, and elective. Emergency operations are those undertaken to stop hemorrhage in patients already in a state of shock in whom it has not been possible before operation to restore the blood volume or to correct, even partially, the acute anemia. Urgent operations are those performed to stop hemorrhage or to prevent recurrence of hemorrhage in patients who are

not in shock but in whom it has not been possible preoperatively to correct completely the anemia the hypoproteinemia, or other factors such as upper respiratory infection, which may increase the operative risk. Elective operations are those performed to rid the patient of the ulcer after a considerable period of time has elapsed following the cessation of hemorrhage and in whom all the aforementioned deficiencies have been corrected.

Although some disagree (29, 30) it is the testimony of many observers (2, 8, 13, 14) that whereas massive hemorrhage which is indistinguishable from that in the early course of a fatal hemorrhage can arise from a small anterior wall gastric or duodenal ulcer the patients who die are those whose bleeding comes from ulcers which are eroding large arteries namely the pancreaticoduodenal and the right and left gastric arteries. Apart from demonstrating by roentgenogram that the ulcer lies in one of these areas and from taking into account the patient's age there is as yet no satisfactory method for deciding early in the course of the hemorrhage which patients will stop bleeding on conservative treatment. Since the use of an unduly prolonged trial of conservative therapy in making this decision will occasionally leave one with an exsanguinated patient upon whom one is forced to perform an emergency operation and with it accept only a 60 to 70 per cent chance of survival we have used earlier operation on a larger group in order to avoid this eventuality. Specifically we have advocated and performed the urgent operation for any patient over 45 years of age who continues to bleed massively from a proved peptic ulcer for more than 24 hours after admission or who having bled massively and stopped has shortly thereafter bled again.

*B Exclusion of the ulcer* The types of operation that have been advocated for bleeding ulcer are outlined in Table I. We have adopted as the ideal operative program a subtotal gastrectomy which entails removal of the lower two-thirds of the stomach including the pylorus followed by the re-establishment of bowel continuity by an end-to-side gastrojejunostomy. Removal of the ulcer may be safely accomplished as part of this procedure

if it is on the anterior surface of the stomach or duodenum. If the ulcer is on the posterior surface and is penetrating the pancreas or gastrophrenic ligament, however, we have considered the additional procedure of removal of the ulcer too formidable to undertake in these patients. In such circumstances therefore we have performed exclusion of the ulcer on the assumption that diversion of the gastrointestinal stream from its surface will avoid repeated digestion of the normal clot which forms within it.

There is evidence to show that even in the most severe bleeding from ulcer clotting will occur intermittently during its course but that this clot will be redigested by the gastric juice passing over it. First in fatal cases death does not occur until some time has passed. Allen found that in 20 fatal cases the average length of time from onset to death was 16 days. Chiesman reports that in 46 fatal cases none died within the first 48 hours. Thorstad found the average period in the hospital of all fatal cases to be 6 to 10 days. It is difficult to believe that uninterrupted continuous bleeding would have allowed patients to survive for these periods even with the aid of multiple transfusions. Second Finsterer reports in a large group of cases that the ulcer is usually not bleeding at the time surgery is undertaken but contains a soft clot in a vessel in the ulcer base. On the basis of this evidence we have proceeded on the assumption that exclusion of the ulcer from the action of the gastric juice is the one most important factor in preventing recurrence of hemorrhage.

Of our 54 patients who had bleeding from peptic ulcer 29 were considered to have a massive hemorrhage (red blood corpuscles below 3,000,000 per cu mm). Twenty of these 29 bled rapidly and seriously. Of this 20 continued to bleed or the bleeding having stopped, bled again. Of these 10 4 were over 45 years of age and having proved peptic ulcers received urgent operation. Their postoperative courses were satisfactory and there were no deaths. Of the 4 patients operated upon 1 had a small anterior wall duodenal ulcer, bleeding from which probably would not have been fatal. A subtotal gastric resection with excision of the duodenal ulcer was performed. A

simultaneous cholecystectomy and choledochostomy was also carried out because of the incidental discovery of gall stones. In the other 3 cases the ulcers were of the posterior penetrating variety and had eroded large arteries. Each ulcer was treated by exclusion. Since they presented three different problems in technical management illustrative of the three types of situation which call for exclusion rather than excision they are reported in detail.

#### CASE REPORTS

**CASE 1** The patient was a male steam fitter aged 53 years who entered the hospital on May 29, 1947 because of melena of 1 week's duration and because of a fainting attack on the morning of admission.

Past history disclosed that the patient had had a diagnosis of peptic ulcer made in 1934 at another hospital following admission there for abdominal pain. At a second hospital admission in 1940 and following another x-ray examination of his stomach he was told that he had a duodenal ulcer. Since that time he had had symptoms typical of ulcer and 3 weeks prior to the present admission he had an exacerbation of his epigastric pain which continued steadily until admission.

On admission the patient was extremely pallid and was mentally confused so that an adequate history was difficult to obtain. The blood pressure was 120/80, the pulse 110, and the temperature 101.4 degrees. The physical examination was otherwise negative.

The red blood cells were 2,200,000 per cubic millimeter and the hemoglobin 8.4 grams. Urine sediment showed 7 white blood cells per high power field and there were 4 to 6 granular casts per low power field.

The patient was placed on a diet consisting of two-hourly feedings of milk and cream and was given dilaudid and sodium luminal for sedation and during the succeeding 2 weeks he received 4,000 cubic centimeters of blood intravenously. He continued to pass tarry stools all showing a plus test for occult blood. The red blood count and hemoglobin fell during the first 3 days to 1,900,000 and 5.4 grams respectively but 6 days later had risen to 3,400,000 red blood cells and 7.9 grams of hemoglobin when they again fell to 2,400,000 red blood cells and 7.9 grams of hemoglobin. Gastrointestinal x-ray examination performed on May 30, the day after admission showed a large diverticulum 3 by 6 centimeters on the lesser curvature of the stomach, a thickening of the gastric rugae with folds radiating toward the diverticulum, a deformed duodenum with a large diverticulum projecting from its greater curvature side, and a third diverticulum projecting to the left of the descending portion of the duodenum.

Because of the patient's continued or persistent bleeding he was operated upon on June 14, 15 days

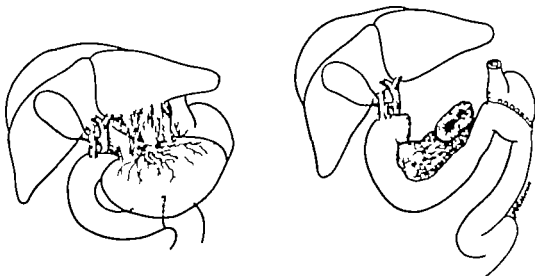


Fig. 1. Diagram of the operative procedure in Case 1. A standard subtotal gastric resection was performed removing the distal three fourths of the stomach including the pylorus. The gastric ulcer is shown remaining *in situ* against the pancreas but excluded from the gastrointestinal tract.

after admission. A subtotal gastrectomy was performed removing the lower three fourths of the stomach including the pylorus. A Hillmeister type of anastomosis was effected anterior to the colon. An ulcer 2.5 by 5 centimeters was found to be eroding the upper edge of the pancreas and the left gastric artery. This ulcer was not actively bleeding at the time and it was left *in situ* but excluded from the gastrointestinal tract (Fig. 1). It was apparently the cause of the diverticulum seen in the roentgenogram. The duodenum, contrary to the diagnosis made by means of the x-ray, seemed normal.

The patient's convalescence was smooth. He received 500 cubic centimeters of blood on the day following surgery and another 500 cubic centimeters 11 days later. The red blood cells were 4,300,000 per cubic millimeter 14 days after operation with 12.5 grams of hemoglobin. The first stool passed after operation was of a tarry nature but subsequent stools were brown and on the eleventh postoperative day the guaiac test for occult blood had changed from 4 plus to 2 plus.

The case is that of a large gastric ulcer penetrating the pancreas which bled persistently and massively for a period of 3 weeks. Diagnosis by means of the x-ray had been made during the episode of bleeding. Urgent surgery was performed 15 days after admission. A standard subtotal gastric resection was performed removing the lower three fourths of the stomach including the pylorus. The ulcer was left *in situ* in the pancreas but excluded from the gastrointestinal tract.

CASE 2. A 55 year old male automobile mechanic entered the hospital on December 10, 1946, because of a 3 day story of tarry stools, hematemesis and weakness. Three days before admission the patient began to have severe epigastric pain. Two days before admission he was awakened in the morning by severe pain which was followed by syncope by the vomiting of considerable quantities of black material and by the involuntary passage of black stools. The patient was disoriented after recovering consciousness.

One year prior to entry the patient had passed tarry stools and had had a period of 3 days of "weakness." He had had a chronic cough for many years and was admittedly a heavy drinker. He said that he had had arthritis for 7 years.

He showed marked pallor but was mentally clear. The temperature was 98.6 degrees, the pulse 80, and the blood pressure 120/80. There was marked tenderness in his midepigastrium.

The red blood cells were 2,500,000 per cubic millimeter with 7 grams of hemoglobin. Urine was normal, blood nonprotein nitrogen 41 milligrams per 100 cubic centimeters, and the blood glucose 67 milligrams per 100 cubic centimeters. The serum protein was 8.4 grams per 100 cubic centimeters.

The patient was placed on an ulcer diet with three hourly feedings and was given sodium laminal and atropine. On the day following admission his temperature rose to 101.8 degrees and his pulse to 110. He complained of more pain and vomited blood-stained material which was not bloody. A course of penicillin injections was started and his temperature subsided on the fourth hospital day although his pain continued. On the third fifth and sixth day in the hospital the patient had massive melena and on the sixth day he went into shock, the blood pressure

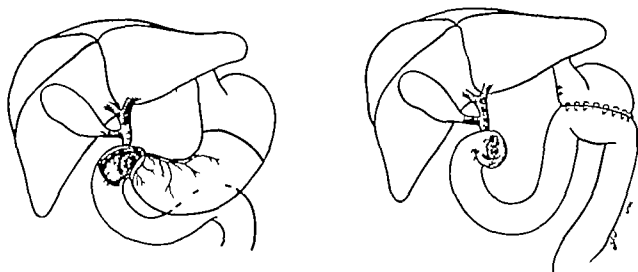


Fig. 2 Diagram of the operative procedure. In Case 3 A standard subtotal gastric resection was performed removing the lower three fourths of the stomach including the pylorus. The duodenal ulcer is shown remaining *in situ* posteriorly within the duodenum immediately distal to the duodenal stump. It remains in the gastrointestinal tract but is excluded from the gastrointestinal stream.

falling to 80/60 and his pulse rising to 120 the hemoglobin this day being 7 grams. He had received 1 500 cubic centimeters of blood during the 6 days following admission. Because of this recurrent hemorrhage the patient had an emergency gastrointestinal x ray series on the fourth day in the hospital at which time a duodenal ulcer was visualized.

On the seventh day after admission urgent operation was performed. The patient was found to have a posterior wall duodenal ulcer about 1.5 centimeters in diameter and 2 centimeters distal to the pylorus. In the center of this ulcer was a hard cartilaginous nodule at the apex of which was an open blood vessel which was not bleeding. A subtotal gastrectomy was done a posterior Hofmeister type of gastroduodenostomy being used. The gastroduodenal segment was transected just distal to the pylorus and the duodenum turned in so that the turned in tuft of duodenum lay in the ulcer crater (Fig. 2). The patient received 1 000 cubic centimeters of blood on the day of operation.

Convalescence was smooth. The patient received 500 cubic centimeters of blood on the second postoperative day. By the tenth day the red blood cells were 3 700 000 and hemoglobin 12 grams. There was no external evidence of further bleeding.

The case is that of a large posterior wall duodenal ulcer which bled recurrently and massively for 10 days prior to surgery. The diagnosis was made by means of x ray examination carried out during the bleeding episode. Urgent operation was performed, the gastroduodenal segment being transected between the pylorus and the ulcer which was excluded and left *in situ* in the duodenum distal to the turned in duodenal stump.

CASE 3. A 49 year old male post office inspector entered the hospital on May 19 1947 because of progressive weakness over a period of 5 days associated with melena and hematemesis.

His illness started 2 weeks before admission when he began to have severe epigastric and left upper abdominal pain which was not relieved by food or antacids. Five days later this pain became more noticeable in the chest rising behind the sternum into the throat. At this time he first noticed tarry stools. Four days before admission he had hematemesis and had two more subsequently with continued tarry stools.

The patient had ulcer symptoms for 16 years and in 1938 an x ray examination showed a duodenal ulcer but there had been no previous hemorrhages and no symptoms of perforation or of pyloric obstruction had been present.

Physical examination showed extreme pallor of the skin restlessness deep sighing respiration and there was dried blood about the nostrils and mouth. Blood pressure was 90/50 and pulse rate 120.

Laboratory studies revealed a hemoglobin of 5 grams and a urine which was negative except for a 1 plus positive test for acetone and 5-10 white blood cells per high power field in the sediment. Blood leucocytes were 25 000 per cubic millimeter.

The patient was put on a milk and cream diet and phenobarbital and atropine. He received 1 000 cubic centimeters of blood on the day of admission and 1 500 cubic centimeters from the second to the fifth day. The pain in the epigastrium continued and was quite severe. He vomited a small amount of blood on one occasion. The red blood cells rose to 3 500 000 and the hemoglobin to 6.9 grams by the fifth day in the hospital when he vomited 300 cubic centimeters of coffee-ground material and 600 cubic centimeters more was removed from his stomach by aspiration. The red blood count fell again to 2 500 000 red cells.

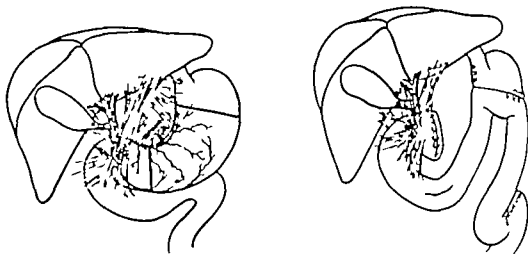


Fig. 3. Diagram of the first operative procedure in Case 3. A subtotal gastric resection was performed removing the distal three fourths of the stomach including the pylorus in 1 stage. The first stage is shown here. The stomach is transected 8 centimeters proximal to the pylorus and the distal cut end closed. The duodenal ulcer surrounded by a large inflammatory mass is shown excluded from the gastrointestinal stream as in Case 2.

On the sixth day an emergency gastrointestinal roentgenogram was taken which showed the large crater of an ulcer in the region of the pylorus.

On the sixth hospital day operation was performed. There was found an inflammatory mass 8 centimeters in diameter in the region of the pylorus. The first stage of a two stage subtotal gastrectomy was performed, the gastric antrum being transected 3 inches proximal to the pylorus and closed in. There was no evidence of fresh blood in the stomach, but visualization of the ulcer crater through the pylorus could not be obtained. The middle half of the stomach was resected and a posterior Hofmeister gastrojejunostomy performed (Fig. 3). During the morning prior to operation 1,500 cubic centimeters of blood were given during and following operation.

Convalescence was satisfactory. The red blood cells on June 6, 1917, two days after operation were 4,500,000 per cubic millimeter and the hemoglobin 11.8 grams. The stools were positive for occult blood on the first few days after operation but on the twelfth postoperative day they were negative for occult blood. The patient was discharged on the seventeenth postoperative day.

He returned to the hospital on July 23, 1917, forty-nine days after the first stage operation and a second stage gastrectomy was performed 5 days later. At this operation the inflammatory mass had apparently completely subsided. The removal of the antrum, the pylorus and the scar of duodenal ulcer, now about 2 centimeters in diameter with a turn in of the duodenum distal to the ulcer, was easily performed. The convalescence was uneventful.

The case is that of a large posterior wall duodenal ulcer associated with a large inflam-

matory mass. The patient had had symptoms of severe ulcer activity for 3 weeks with recurrent massive hemorrhage for 12 days prior to surgery. Urgent first stage gastrectomy was performed excluding the ulcer but not excising it. Later a second stage gastrectomy with removal of the ulcer was carried out.

#### DISCUSSION

These 3 cases represent three types of situation that may arise when the ulcer is difficult to remove. In Case 1 the penetrating gastric ulcer, the ulcer could be completely excluded from the intestinal tract although it was left *in situ* in the pancreas. In Case 2 the penetrating duodenal ulcer situated some distance from the pylorus, the gastroduodenal segment could be transected between the pylorus and the ulcer which was left *in situ* in the duodenum. In Case 3 the penetrating duodenal ulcer which caused the large juxtapyloric inflammatory mass, the gastroduodenal segment was transected proximal to the pylorus and at a later second stage the removal of the gastric antrum and the pylorus was done in the manner advocated by McKittrick. In Cases 2 and 3, although the ulcers were left *in situ* within the intestinal tract, they were effectively excluded from the intestinal stream and no further bleeding occurred.

We realize that early operation in these older patients which is advocated to forestall a fatal outcome in a minority of cases does subject to operation a larger number of patients whose bleeding might have stopped had conservative treatment been continued. We therefore feel that to justify the adoption of this more radical policy it must satisfy 5 criteria (1) it must stop active hemorrhage and prevent recurrent hemorrhage (2) it must entail the use of the simplest possible operative procedure (3) this operative procedure must give the patient as complete protection against recurrent or marginal ulcer as would a later elective operation (4) it must not submit to operation patients in whom there would be no indication for later resection assuming the hemorrhage could be successfully treated by conservative means (5) it must not result in a mortality rate higher than that expected for the elective surgery of peptic ulcer in a similar age group

We consider criterion 1 to be satisfied by the exclusion of the ulcer from the gastrointestinal stream criteria 2 and 3 by resorting to exclusion of the ulcer or the two stage operation under the indications outlined and 4 by the group selected most of whom being older patients with severe hemorrhage would be recommended for elective surgery at a later date supposing the hemorrhage to have been successfully treated by conservative means. Whether criterion 5 is fulfilled under this policy cannot be told until a large selected group of these patients is analyzed and comparable mortality rates determined. Our experience with these few cases has been most favorable and we believe justifies a continuance of the policy.<sup>1</sup>

The credit for advocating the exclusion operation in selected cases of bleeding belongs to Finsterer to Gray and Sharpe and to Allen. We should mention here a point which needs further emphasis. If an exclusion operation has been performed which entails leaving any part of the gastric antrum *in situ* this remnant of the antrum should be removed at a later date in order to avoid a marginal ulcer. The high incidence of jejunal ulcer following gastric resections in which antral mucosa has

been left *in situ* has been recognized by many. The removal of the antrum at a second stage following the performance in selected cases of a first stage exclusion operation has been advocated by McKittrick. We feel with him that the term 'first stage gastrectomy' is in these cases preferable to 'exclusion operation'.

The credit for advocating early operation undoubtedly belongs to Finsterer who apparently operated on all massive bleeders within 48 hours after onset. We have considered our more rigid selection of cases however as preferable to his broader indications.

We have not adequately discussed the technique of management of patients who at operation are found to be actively bleeding from the ulcer bed. We feel that under a policy of urgent surgery for the older age group few such situations will arise. It is undisputed that when such an occasion arises an attack of some sort on the bleeding vessel must be made. Access to the ulcer bed is available directly in such situations as those illustrated by Case 1 and indirectly through the transected duodenal stump in such a condition as is illustrated by Case 2. In these cases by direct application to the ulcer of pressure or of hemostatic agents such as muscle fibrin foam or gelatin sponge the bleeding can readily be stopped. The situation is then identical with that in which the bleeding was not in progress when the abdomen was opened and exclusion of the ulcer can be performed. If active bleeding is in progress from the ulcer when the situation is as outlined in Case 3 one must decide at operation whether to rely on the exclusion procedure to permit the formation of a clot or whether a direct attack through an incision in the anterior face of the gastroduodenal segment is needed. It is our opinion that the latter will rarely be necessary. If it is undertaken however the technique of reconstructing the duodenum and antral remnant as described by Allen should be used.

#### SUMMARY AND CONCLUSIONS

The use of methods of nonsurgical treatment of massive bleeding from peptic ulcer which have been produced to date has always resulted in a small percentage of cases which

<sup>1</sup>Since this group was studied 6 more patients have received urgent operation without mortality.

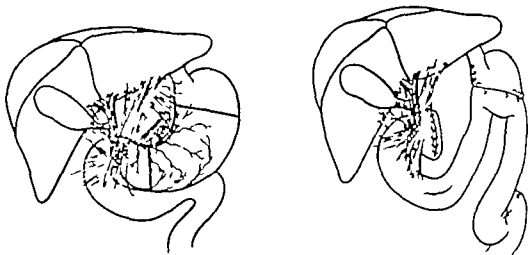


Fig. 3 Diagram of the first operative procedure in Case 3. A subtotal gastric resection was performed removing the distal three fourths of the stomach including the pylorus in two stages. The first stage is shown here. The stomach is transected 8 centimeters proximal to the pylorus and the distal cut end closed. The duodenal ulcer surrounded by a large inflammatory mass is shown excluded from the gastrointestinal stream as in Case 2.

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Convalescence was satisfactory. The red blood cells on June 6, 1947, two days after operation were 4,500,000 per cubic millimeter and the hemoglobin 18 grams. The stools were positive for occult blood on the first few days after operation but on the twelfth postoperative day they were negative for occult blood. The patient was discharged on the seventeenth postoperative day.

He returned to the hospital on July 23, 1947, forty-nine days after the first stage operation and a second stage gastrectomy was performed 2 days later. At this operation the inflammatory mass had apparently completely subsided. The removal of the antrum, the pylorus and the scar of duodenal ulcer now about 3 centimeters in diameter with a turn in of the duodenum distal to the ulcer was easily performed. The convalescence was uneventful.

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# ROUTINE USE OF OPERATIVE CHOLANGIOGRAPHY

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THE need for additional diagnostic methods to improve the results in gall bladder surgery has long been acknowledged. In 1936 Lahey concluded that previous to 1926 he had left a stone in the common duct in one out of every ten patients subjected to a cholecystectomy. In an effort to decrease this high incidence Lahey increased common duct explorations to 44 per cent in a series of 2 000 cases with the discovery of calculi in 18 per cent of the last one third of this series (8). In view of the increased mortality and morbidity associated with choledochostomy it is easy to understand the reluctance of most surgeons to explore the common duct unnecessarily. Secondary operations are sufficiently formidable however to justify considerable effort to prevent them.

The possibility that careful study of diagnostic methods other than operative ones might improve results led Mirizzi, Best, Hicken, and others to the use of immediate or operative cholangiography (2, 6, 7, 11, 13, 14). In spite of the variety of contrast media and varying surgical and roentgenographic techniques used their results nevertheless showed the value of this procedure. Although these results were reported by Mirizzi in 1931 and by Best and Hicken in 1936, operative cholangiography has not been generally adopted due chiefly to prolongation of operating time and difficulty in the interpretation of technically inferior films (20).

The purpose of this paper is to report our results with the routine use of operative cholangiography on all patients requiring gall bladder or common duct surgery during the past year 1946-1947. An attempt has been made to eliminate the causes for poor films and delay. The technique to be described has been

functioning to the satisfaction of the surgeon and the radiologist. It must be emphasized that not only interest but absolute co-operation must be maintained during the procedure. The slightest miscalculation on the part of any one of the team will nullify the entire examination or necessitate its repetition.

## TECHNIQUE

The technique of operative cholangiography is simple and excellent films can be obtained routinely with attention to a few details. The procedure does not prolong the operation more than 5 to 10 minutes. The only special equipment necessary, a plywood tunnel, can be fabricated quickly in any hospital utility shop.

The patient is placed on the operating table with a plywood tunnel beneath his abdomen and lower thorax without an intervening mattress. A pad of the same thickness as the tunnel covers the rest of the table. The tunnel should be large enough to permit easy passage of a cassette carrying a 14 by 17 inch x ray film and a grid. A 10 by 12 inch cassette and grid can be used just as effectively but requires more accurate centering. Use of the tunnel precludes the use of a gall bladder rest, though this may be compensated for partially by means of folded towels. Drapes and wound towels are sewed in place to avoid the presence of metal towel clips in the roentgenogram.

The choice of incision is governed by the width of the costal angle. Paracostal or transverse incision allows the catheter containing the radiopaque substance to be brought in from the side without obscuring any of the underlying duct system. Following the opening of the abdomen, this biliary duct system is carefully inspected and the cystic duct at its junction with the common duct is dissected. A tie is placed on the cystic duct close to the gall bladder to prevent injection of radiopaque material into the gall bladder. If the gall bladder is filled with dye, it produces a dense shadow which may often overlie the sphincter of Oddi or some other part of the choledochus.

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come to the surgeon because these medical measures have failed. In these cases, especially if there has been a prolonged trial of such a medical regimen the postoperative mortality is high.

Early urgent operation is, therefore advocated on all patients with massive hemorrhage from peptic ulcer who are over 45 years and in whom the hemorrhage persists after 48 hours following admission to the hospital or having stopped recommences.

Subtotal gastrectomy with removal of the lower two-thirds of the stomach including the pylorus, should be the surgical plan for these patients.

In those patients in whom the ulcer is technically difficult to remove a subtotal gastrectomy with exclusion but not removal of the ulcer is advocated. In patients with a large inflammatory mass involving the pylorus and duodenum a two stage subtotal gastrectomy as described by McKittrick should be done.

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Technical results were found to be directly dependent upon the team's experience with the procedure. The team consisted of a surgeon, radiologist, anesthetist, and technician. A number of different teams took part in the present study so that the results could not be expected to be as good as if one team had done the entire group.

Of the group of 30 cholangiograms, 17 cases (56%) were excellent, 10 cases (33%) were diagnostically adequate but had technical shortcomings, and 3 cases (10%) were failures. To account for the failures, in one instance the needle slipped out of the common duct and the diodrast was deposited as an indiscriminate mass in this region. In the second, due to uncertainty that the needle was in the common duct, it was withdrawn and reinserted. Diodrast leaked from the hole in the common duct at the site of the initial puncture and obscured the detail. The third case was a false positive in which two spherical negative densities were visualized near the junction of the cystic and common ducts. Subsequent common duct exploration and T-tube cholangiogram showed no calculus. The artefact was attributed to air bubbles. In increasing familiarity with the procedure and the difficulties involved, has greatly raised the percentage of diagnostic films during the past few months. Of the last 15 cholangiograms, 12 (80%) were excellent, 2 (13.3%) were diagnostically adequate, and 1 (6.7%) was a failure (Fig. 1).<sup>1</sup>

Although the objective of operative cholangiograms as first used was the determination of the presence of common duct calculi, they have proved a diagnostic aid in other lesions involving the biliary duct system, such as tumors of the head of the pancreas, common duct or liver inflammation or spasm of the sphincter of Oddi, indirectly pancreatitis or hepatitis. The true anatomical picture of the extrahepatic and intrahepatic systems is well visualized (1-17). Following are representa-

<sup>1</sup>Since this paper was presented for publication, an additional 30 patients have received routine operative cholangiography. There has been a marked improvement in the technical excellence of the films due largely to the adoption of the routine of 3 serial cholangiograms with 3 cubic centimeters of the contrast media injected each time. Eighty per cent of the films were excellent, 10 per cent diagnostic, and 10 per cent failures. It is of interest that the failures occurred with new residents not entirely familiar with the procedure.



Fig. 1. Normal operative cholangiogram—catheter overlying part of the common duct. Pancreatic duct well visualized.

tive cases of both calculous and noncalculous lesions selected from the present series in which the diagnosis and subsequent decisions were made during surgery on the basis of routine operative cholangiograms.

There are many cases in which the decision to do a choledochostomy is not difficult. A history of jaundice together with the presence of small stones in the gall bladder, a dilated cystic and a dilated common duct do not permit any other decision. Even in these clear cut cases, however, it has proved to be a definite advantage to know the number and location of the common duct calculi before opening the duct (Fig. 2 a, b, c, d).

There are many other cases in which the decision to do a choledochostomy is not clear cut. It is in these cases that operative cholangiography plays an important rôle. Many of them would not be explored especially if obesity or a borderline cardiac status were an added factor. It is this group that probably

Many media have been used for visualization of the biliary duct system including lipiodol thorotrast hippuran 35 per cent and 70 per cent diodrast (3 12 17) In the present study 70 per cent diodrast has given the best results. Lipiodol is difficult to inject through a small needle and because of its failure to mix readily with bile it gives a higher percentage of false positives. Due to its greater density small stones may also be more readily obscured by it The diodrast should be warmed to body temperature before injection. Previous instillation of a drop of it into the conjunctival sac is employed in an attempt to avoid the infrequent reactions from this material A quarter inch 22 gauge needle is inserted into the common bile duct A small caliber needle of this sort is preferred to minimize leakage of bile after it is withdrawn This needle is connected to a 30 cubic centimeter syringe by means of a foot or more of amber rubber tubing It is preferable to have the syringe and tubing filled with saline to avoid the introduction of air bubbles and to allow the location of the needle to be checked by the injection of a few cubic centimeters of saline inasmuch as it is often difficult to aspirate bile through this small needle After it is certain that the needle communicates with the lumen of the common duct, a syringe containing 70 per cent diodrast is substituted for the saline syringe. Twenty cubic centimeters of this opaque material are injected slowly to prevent sudden dilatation of the biliary tree This procedure generally requires 1 to 2 minutes.

Toward the end of the injection the surgeon announces its progress in cubic centimeters. This serves to warn both the anesthetist and x ray technician of the approaching roentgen exposure As the injection is completed the anesthetist takes control and signals to the technician to make the exposure during a period of respiratory arrest

Recently following Sosman's suggestion a fractionated method of injection has been tried (16 19) In the present series, this has consisted of three injections of 5 5 and 10 cubic centimeters with films being taken after each injection This should obviate the possibility of small stones in the common duct being obscured by the large quantity of con-

trast media in a distended duct. Experience with this technique small amounts of dye being used, has shown better visualization of the anatomy of the common duct, especially in the region of the sphincter of Oddi.

The anesthetic used in this series was intratracheal nitrous oxide, oxygen, and ether. This has the advantage of permitting the patient to be held in respiratory arrest for the 1 to 2 seconds required in making a roentgen exposure. Respiratory arrest is accomplished by having the anesthetist wash out sufficient carbon dioxide in the 5 minute period prior to the injection of the diodrast. Curare has not been used in this series as a means of stopping breathing Spinal anesthesia was not used because of relaxation of the sphincter of Oddi with resultant poorer visualization of the biliary system (5)

Roentgenograms are taken by means of any standard portable shockproof unit, operating at 90 kilovolts, 30 milliamperes, and an exposure of 1 to 2 seconds. For better detail a Lysholm grid is attached to the cassette. Motion is eliminated by synchronizing the exposure with the period of respiratory arrest The cassette is then removed from the tunnel for processing of the film During the time necessary for this the gall bladder is excised, unless unavoidable indications for exploration of the common duct require this to be done first. Wet films are available for inspection and interpretation before the completion of either procedure. If common duct exploration is necessary a repeat cholangiogram is taken through the T tube before the abdomen is closed. The second set of wet films is usually ready for interpretation before the abdominal closure is completed Any further exploration may be accomplished at the comparatively simple cost of removing a few sutures.

#### RESULTS

Routine operative cholangiograms were done in 30 cases during the past year 1946-1947 An analysis of the results revealed that the procedure should be judged, not only as to the technical adequacy of each individual examination but also as to the amount of information which could be furnished the surgeon under optimal conditions.

Technical results were found to be directly dependent upon the team's experience with the procedure. The team consisted of a surgeon, radiologist, anesthetist, and technician. A number of different teams took part in the present study so that the results could not be expected to be as good as if one team had done the entire group.

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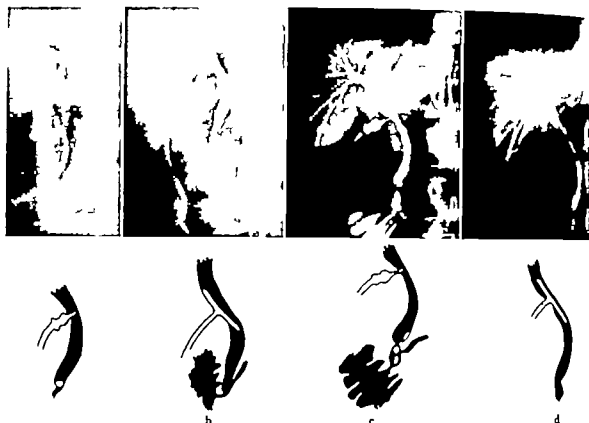


Fig. 1. a, A 26 year old white male with a 3 year history of severe upper abdominal colicky pain requiring morphine for relief and associated with yellow sclerae on one occasion. X-ray showed a functioning gall bladder with multiple calculi. Operative cholangiogram showing filling defect at lower end of common duct. b, Operative cholangiogram through T tube after removal of calculi from the common duct. Duct clear—beginning of pancreatic duct

visualized. c, A 29 year old white male with 3 year history of postprandial epigastric distress activated by greasy food. No history of jaundice. The gall bladder failed to visualize by X-ray on repeated examination. Operative cholangiogram showing 3 negative opacities in the common duct. Notice reflux into pancreatic duct. d, Operative cholangiogram through T-tube after removal of 3 calculi from duct. Duct clear. Spasm of sphincter of Oddi.

contributes the largest proportion of the 10 per cent of common duct stones which Lahey estimated were overlooked at operation. Routine use of operative cholangiography should greatly reduce this figure. It should also prevent the surgeon from exploring a certain number of ducts which appear dilated but contain no calculi. The ability to avoid a common duct exploration in the bad risk patient with confidence that the duct is not involved is certainly worth while.

**CASE 1.** A 51 year old white male was admitted to the hospital with a complaint of indigestion and intolerance to fatty foods which produced nausea and epigastric distress. Past history revealed two attacks of transient jaundice associated with indigestion, nausea, vomiting and pain in the epigastrium. The pain had not been severe enough to require morphine. The patient had been hospitalized

3 years prior to admission for coronary thrombosis.

Physical examination was essentially normal. Roentgen examination revealed a poorly visualized gall bladder containing calculi. Icteric index was normal. Electrocardiograph was consistent with an old coronary thrombosis.

Surgery revealed a thickened gall bladder containing large and small calculi, the largest 3 by 2 centimeters. The cystic duct was small, common duct of average size. Operative cholangiogram showed a common duct which was not distended and contained no calculi. The gall bladder was removed. Subsequent follow-up 3 months later revealed no indigestion or complaints referable to the gastrointestinal tract.

A patient with evidence of coronary sclerosis is obviously not a good risk for unnecessary exploration of the common duct.

Of equal importance in order to prevent overlooking calculi at the time of exploration,

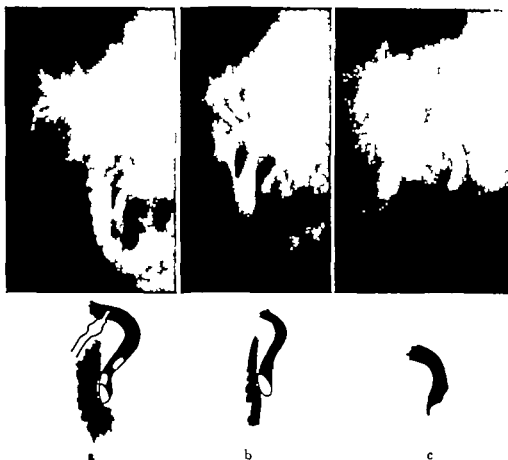


Fig. 3. a, A 35 year old white female with an 18 month history of indigestion and epigastric pain without jaundice. A poorly functioning gall bladder was visualized by x-ray. b, Operative cholangiogram showing several negative densities in the common duct. c, Operative cholangiogram through T tube after removal of 3 calculi from common duct and passage of a No. 12 French woven catheter into duodenum. Negative density still present in region of ampulla. c, Operative cholangiogram through T tube after removal of a fourth calculus from common duct. Duct clear. Some spasm of sphincter.

is the repeat cholangiogram taken through the T tube before the abdomen is closed. In 1 case in which exploration irrigation and passage of a No. 12 French woven catheter into the duodenum disclosed no further calculi repeat cholangiogram showed a stone still present in the ampulla. The partially closed abdomen was reopened and the stone removed with some difficulty by means of a scoop. The final film showed spasm of the sphincter of Oddi due to operative manipulation but no additional calculi (Fig. 3 a b c).

Exploration of the common duct at the time of the removal of an acutely inflamed gall bladder is a difficult and hazardous procedure. The edematous indurated fat surrounding the duct bleeds easily and increases the danger of inadvertent trauma. A history of moderate jaundice which has subsided or the residual presence of slight jaundice make accurate in-

formation about the common duct essential. This may be obtained after the gall bladder has been dissected from fundus to duct. A small needle is inserted into the cystic or common duct and a cholangiogram is taken. Due to some difficulty in being certain of the position of the needle in the lumen of the cystic duct a small cannula has been used recently with good results. A roentgenogram showing a common duct without calculi or dilatation and with dye in the duodenum adds greatly to the surgeon's peace of mind and avoids a difficult and extensive procedure.

CASE 2. A 37 year old white male was admitted to the hospital with a 9 year history of recurrent attacks of right upper quadrant pain associated with vomiting. He had been jaundiced on two occasions for several days. Two days prior to admission to the hospital he again commenced to have severe right upper quadrant pain, nausea and vomiting similar to his previous attacks.



Fig. 4 Case 2. Cholangiogram taken during operation for acute cholecystitis in patient with past history of jaundice. Common duct without calculus, cystic duct stump and pancreatic duct are isolated.

Past history revealed typhoid at the age of 13. The patient appeared moderately acutely ill. There was increased resistance in the right upper quadrant of the abdomen with marked tenderness and rebound tenderness referred to this area.

Laboratory examination revealed white blood cells, 10,100. 80 per cent polymorphonuclear leukocytes. urine normal.

Scout film of the abdomen was negative.

At operation an acutely inflamed adherent gall bladder containing two large calculi was removed from fundus to duct. Operative cholangiogram showed a normal common duct without calculus (Fig. 4). Convalescence was uneventful.

Occasionally in spite of adequate exposure the anatomy of the common and hepatic ducts is not clear especially at secondary operations. When this is true it is most helpful to be able to clarify the anatomy by means of a cholangiogram with the dye injected into the first duct containing bile that is encountered. The resulting picture may eliminate much fruitless searching and prevent injury to the duct system as well as visualizing the pathology present.



Fig. 5 Case 3. a, Operative cholangiogram through catheter showing short segment of common duct with constriction and narrowing but without calculi. b, Operative cholangiogram showing proximal portion of duct system and intrahepatic branching of hepatic ducts.

CASE 3. The patient was a 31 year old white male with a 12 year history of recurring episodes of painless jaundice lasting about a week at a time and coming on several times a year. With his entry into the Army in 1932 the attacks became monthly and were associated with diarrhea. A more severe attack of jaundice overseas in 1944 2 years prior to admission, was diagnosed infectious hepatitis and he was returned to this country. Following a severe attack of abdominal pain radiating to the back, cholecystectomy was performed 6 months later in an Army hospital. The gall bladder was said to have contained stones. Mild intermittent jaundice continued and he received a disability discharge. For the last 6 months prior to admission, the patient had been jaundiced constantly and had had discomfort in his operative scar.

Family history revealed a brother who had had several months of common duct drainage following exploration of the duct for calculi.

Admission physical examination showed mild icterus and slight abdominal tenderness below the xiphoid.

Laboratory examination revealed an icteric index of 25, normal liver function, normal fragility test, and negative duodenal drainage.



Fig. 6. a, A 42 year old colored male with a 3 week history of fatigue and aching abdominal pain and a 3 day history of jaundice. The gall bladder failed to visualize by x ray and the laboratory findings suggested obstructive jaundice. Operative cholangiogram showing dilated biliary duct system with a complete block in the region of the ampulla. b, Opened operative specimen showing carcinoma of ampulla blocking the common duct. c, A 55 year old white male with a 2 month history of itching of the skin and a 6 week history of epigastric pain and jaundice. X ray examination of the gastrointestinal tract showed extrinsic pressure on the duodenal cap. Laboratory studies suggested obstructive jaundice. Operative cholangiogram through a cannula in the cystic duct showing the cystic and hepatic ducts narrowed and the duct system dilated proximal to a complete obstruction. This was found to be due to carcinoma of the common duct involving both hepatic ducts and the cystic duct.

Operation was performed for probable common duct stone. The distance between the portal fissure and the duodenum was not over 3 centimeters. The common duct appeared to be 2 centimeters in diameter but had a lumen which was difficult to find and which admitted a No. 10 French catheter snugly. Operative cholangiogram through this catheter identified the lower end of the common duct with no calculi present and dye in the duodenum (Fig 5a). A constant narrowing and angulation of the duct in the region of the sphincter was diagnosed as probable inflammation of the sphincter of Oddi with spasm. A catheter inserted in the opposite direction visualized the intrahepatic portion of the duct system (Fig 5b). T tube drainage was instituted. The patient continued to have an icteric index up to 33 and had episodes of mild jaundice. He remained afebrile and asymptomatic with the T tube still in place after 5 months. Forty centimeters of water pressure through the T tube produced discomfort

and 50 centimeters caused definite pain. Nitroglycenne and atropine had no effect on the duct pressure. The T tube had been clamped for the month prior to his last follow up without a return of jaundice or pain.

Operative cholangiography was of great value in this case in proving that the small duct obscured by a greatly thickened wall was really the common duct. Without it identification of the proximal portion of the biliary tract would have been more difficult.

Operative cholangiography has also proved useful in the diagnosis of tumors of the bile ducts and head of the pancreas. Dye injected into the dilated portion of the duct system shows the nature and completeness of the block without dissection in the region of the



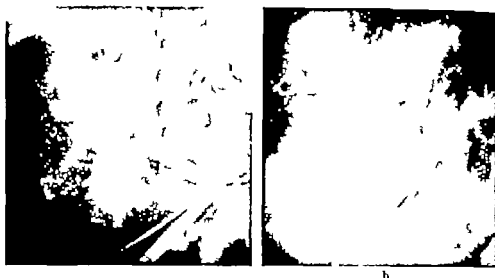


Fig. 7 a, Right hepatic duct displaced to the left by tumor in right lobe of liver. Left hepatic duct is not involved. b, Normal, right and left hepatic ducts and tributaries. Reprinted through courtesy of Dr. Paul Rudström (*Acta Radiologica*).

tumor. Where doubt still remains at surgery as to whether or not a tumor exists in the ampulla or head of the pancreas surrounding it it is much simpler to take a cholangiogram than to open the duodenum and explore the region (Fig. 6 a b c).

**CASE 4.** A 26 year old white male was admitted to the hospital with a two year history of dull aching epigastric pain. The pain occurred after eating, was sometimes colicky and did not radiate. Six months prior to admission he had noticed anorexia and had lost a total of 50 pounds up to the time of admission. Six weeks before admission he became icteric. This cleared somewhat on bed rest and a fat free diet and then recurred. Past history was noncontributory except for a period of moderately severe alcoholism following discharge from the Navy.

Physical examination showed a well developed deeply icteric white male who had obviously lost considerable weight. There was direct and rebound tenderness in the upper abdomen. The liver and spleen were not felt.

The icteric index varied from 110 to 190, cephalin flocculation test 4+ 40 per cent retention of bromsulfalein in 30 minutes, normal fragility test. Serum amylase rose to 96. X-ray examination of the upper intestinal tract revealed a normal esophagus, stomach and duodenum. Cholecystograms were not taken because of the icterus. The patient's upper abdominal tenderness increased and localized in the right upper quadrant and his temperature commenced to swing up to 100 degrees daily.

Exploration was performed with a diagnosis of acute and chronic cholecystitis with common duct stone. At operation the gall bladder was quite dis-

tended, would not empty but contained no calculi. No calculus was felt in the common duct. The head of the pancreas was quite firm, and a diagnosis of carcinoma was considered. A cholangiogram was taken with a needle in the lumen of the common duct. This showed a common duct of normal appearance with dye entering the duodenum readily. Bile specimens were taken from the pancreas and liver which were later reported as normal pancreas and acute inflammation of the portal areas of the liver. The patient had an uneventful convalescence and regained his appetite. The icteric index dropped to 25 and the bromsulfalein test returned to normal. He was discharged on the 19th postoperative day feeling well.

#### DISCUSSION

The success of routine operative cholangiography is directly dependent upon the ability to produce a cholangiogram of good diagnostic quality, with a negligible loss of time. The closest co-operation of the surgeon, radiologist, anesthetist and x-ray technician is essential. Passive indifference on the part of the surgeon or radiologist toward the perfection of operative cholangiography only negates the procedure. Even the slightest respiratory motion during the course of exposure due to lack of co-ordination by either the anesthetist or the technician can entirely destroy the value of the examination.

Due to the various components involved, although operative cholangiography is not

difficult, it seemed wiser to follow MINIZZI's example and attain maximum proficiency by making the procedure routine. This had the added value of thoroughness in an effort to prevent overlooking biliary tract disease. Russell Best is of the opinion that cholangiograms are as essential to the surgeon doing gall bladder surgery as a gastrointestinal series is before considering a gastric resection (2).

Interpretation of cholangiograms is not difficult provided one bears in mind the various artefacts that may occur and how to avoid them. Common causes for misinterpretation are the presence of air bubbles in the common or hepatic ducts, the inadvertent placement of the tubing carrying the opaque material too far medially so that it overlies and obscures the extrahepatic biliary system, and failure to insure proper placement of the needle in the lumen of the common duct which causes dye to pool in the vicinity. The injection of dye must not be too rapid or the biliary tree will overdistend again giving false evidence of pathology. All of these mishaps can usually be remedied by repeating the cholangiogram as soon as the wet films are inspected. The needle hole in the common duct has generally ceased leaking and can be disregarded. The additional time loss is not great.

Most common duct calculi are non-opaque. If precautions have been taken to exclude air from the system, negative shadows in the intrahepatic or extrahepatic systems are indicative of calculi. Although it is possible that negative shadows might be due to blood clot or intraductal tumor, these have not been present in our experience. However, false negative shadows caused by borders of vertebrae and gas in the intestine may be encountered. Deviation or deflections of either hepatic duct or the main branches may be due to space occupying lesions. Rudström described 2 cases of intrahepatic disease which were diagnosed by means of operative cholangiography. In one instance a tumor of the right lobe of the liver was demonstrated displacing the right hepatic duct (Fig. 7 a and b). Marked distention of the hepatic radicles is

indicative of a mechanical block. Tumors of the ampulla of Vater or head of the pancreas are funnel shaped or irregular. Spasm of the sphincter of Oddi may be encountered if dye is injected too rapidly.

In the past the objections to operative cholangiography have been poor films, insufficient information obtained, and too much time consumed in the examination. Attention to the aforementioned details, perfection of technique, and consequent improvement of interpretive diagnosis should largely dispose of these objections.

#### SUMMARY

1. The results of a year's experience with the routine use of operative cholangiography have been presented.

2. A simplified technique using readily available equipment is described.

3. The types of cases in which operative cholangiography has proved useful are discussed.

4. Reasons for technical failures and false positive diagnoses are mentioned with suggestions for their correction.

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# ATRAUMATIC LOW THIGH AMPUTATION

## Further Modification of and Experiences with Technique

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SINCE 1936 the writer has been especially impressed with low thigh amputation performed according to the basic principles advanced by Callander (3,4) in 1935 in which no muscle bellies are cut. The operation was originally devised to lessen shock and to prevent the proximal spread of infection. Attention was directed to the following anatomical facts: (1) The popliteal space is a closed space; the intact upper limit of which acts as an effective barrier to the spread of infection. (2) section only of tendon preserves this bulwark against infection, whereas section of the fleshy portions of muscles destroys it. (3) the tissues of the lower thigh, knee and upper leg are supplied by the deep femoral artery which is rarely affected by occlusive arterial disease even in patients in whom the superficial femoral artery is completely occluded.

In the Callander technique long viable skin flaps are fashioned from the upper leg; all transections of muscles are done through their tendinous insertions; the bone is sectioned through the flares of the condyles; the patella is excised and its bed made available as a cover for the bone end; the skin and subcutaneous tissues are approximated loosely. As the hamstrings draw the posterior flap cephalad, the patella bed is directed over the bone and the skin flaps retract to fit snugly about the bone. The technical and anatomical points in this procedure lend themselves very favorably to amputation for peripheral vascular disease and the author continued to use this technique in the first fifteen amputations for peripheral vascular disease done according to the Callander principle. Because of a somewhat high percentage of delayed healing, persistent edema of the stump and mobility of the patella bed which interfered with the function of the prosthesis, the writer modified the procedure and in 1941

he reported details of his new technique (1) which in general consisted of the following changes: (1) The skin flaps were of the "fish mouth" type and of similar length and contour. (2) the patella and the peripatellar tissues were completely removed. (3) the bone was not sectioned through the condyle flares but through the medullary portion of the femur 2 1/2 to 9 centimeters above the epicondyles.

The author's modification produced a definite improvement in the tendency to heal per primam in the contour of the stump and in the fitting and functioning of the prosthesis. It was usual however for an appreciable amount of clear or slightly bloody fluid to form in the stump and be discharged for 3 to 9 days through the openings left at the apex of the suture line. Often there was enough fluid to soak the dressings. In some cases the formation of fluid continued after the suture line healed, requiring its evacuation. In a good number of cases evidence of fluid accumulation in the stump persisted for many weeks, even months, causing edema in the region of the suprapatellar bursa which delayed the shrinking process and interfered with the satisfactory use of the prosthesis.

In the author's modification as well as in the original technique the suprapatellar bursa remains intact, and a considerable portion of the synovial membrane of the bursa is left in the stump. This membrane may well continue to secrete synovia and be responsible for the discharge of fluid which often occurs. In an attempt to eradicate this factor the author has further modified the procedure, removing the synovial membrane in accordance with the technique described and illustrated below.

### TECHNIQUE

The operation proceeds as usual with the formation of skin flaps; tenotomy of the medial hamstrings; opening of the popliteal space; section of the vessels and nerve; tenotomy of

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the biceps femoris and tensor fascia femoris scalping back the anterior flap, mobilization of the posterior flap entering the knee joint through the tendon of the quadriceps femoris and section of the retinacula genu. These steps are described in detail and illustrated in a previous article by the author (17). The anterior flap is drawn sharply cephalad exposing by inversion the depths of the suprapatellar bursa, and the additional step is carried out as follows (Fig. 1).

The edges of the synovial membrane are grasped with forceps and the membrane gently separated from the underlying structures. The dissection is begun medially first freeing the membrane from the underlying muscle fibers of the vastus medialis then laterally from the tendinous fibers of the vastus lateralis as the dissection is carried toward the midline. The membrane is loosely attached to these structures by the interposition of a well defined layer of areolar tissue of definite thickness and separates easily. When the undersurface of the quadriceps tendon is reached however the membrane becomes thin and intimately attached to the tendon so that a clean cut separation is made impossible. The membrane is freed as much as possible and the undersurface of the quadriceps tendon is scraped clean of the remainder with a curette. If desired a thin shaving of the tendon may be removed with the synovial membrane in order to eliminate the membrane completely but the tendon is extremely tough and a clean removal of a slice is difficult. As the membrane previously freed on each side now medially is mobilized it is gradually reflected caudad off the vasti the retinacula the tendon of the quadriceps femoris and the anterior surface of the femur to a point caudad to the proposed site of bone section (Fig. 1). The separation from the femur is also easily accomplished because of the interposition of loose areolar tissue. Thus the entire secreting membrane forming the suprapatellar bursa is removed with the specimen. The section of the bone and the closure are carried out as previously described (17).

In 1943 Pearl and Misrak (19) reported their experience with the atraumatic amputation through the lower thigh a technique which

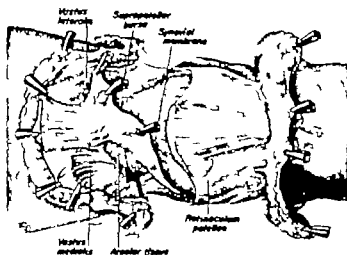


Fig. 1. The suprapatellar bursa has been entered through the tendon of the quadriceps femoris and the retinacula sectioned. The anterior flap has been drawn sharply cephalad, and the depths of the suprapatellar bursa have been exposed by inversion. Hemostats grasp the edges of the synovial membrane which forms the bursa. The synovial membrane has been freed from the vasti laterally and partially from the undersurface of the quadriceps tendon medially. It will be dissected caudad to a point distal to the proposed bone section indicated by the broken line, and will be removed with the specimen.

cuts no muscle bellies. Several additional points which are the result of further experience with this method of procedure are worthy of mention.

**Skin flaps.** In fashioning the posterior skin flaps the knee should be held in about 15 degrees flexion. If the flap is marked out with the knee in full extension it will be too short. In legs with a goodly amount of subcutaneous fat the flaps should be about equal in length. In thin muscular legs the posterior flap should be made about 1 to 1½ centimeters longer because of a greater tendency to retract. In making the curve for the posterior flap the stump contour will be improved if care is taken to eliminate the "dog ears" by avoiding a sweep which is too circular.

**Treatment of sciatic nerve.** The sciatic nerve was formerly injected with absolute alcohol to prevent neuroma formation. There is no apparent difference in postoperative pain or phantom limb sensation when the alcohol is omitted. The nerve is gently drawn down all ways ligated firmly as high as possible with fairly strong material in order to control the bleeding from the cut end and sectioned about 2 centimeters distal to the ligature with knife

or razor blade—never with scissors. The ligature is left long so that the end may be inspected just before closure is made as bleeding from the arteria comitans is a common cause of hematoma and delayed healing. It is not unusual for the nerve to require a second ligature.

*Sawing the bone* The Gigli wire saw is in the author's hands, the most efficient and a traumatic instrument with which to section the bone. Some difficulty may be encountered in holding to the perpendicular in both planes and he has often asked an observer to check the alignment as the section progressed. The assistant should support the bone in its original alignment until the bone has been completely divided in order to prevent fracture during the last portion of the section. The periosteum is allowed to reach the bone end no cuff is removed. Bleeding from the bone is another frequent cause of hematoma in the stump and should be thoroughly controlled before closure. More recently a thin piece of absorbable oxidized cellulose cut to fit and applied to the bone end has been used for hemostasis. The author prefers it to bone wax.

*Special care of biceps tendon* If the bone section is high or the biceps long the latter may tend to prolapse from the wound through the spaces left for drainage (see closure). To avoid this the cut end of the biceps is anchored to the tissue about the bone with a suture.

*Irrigation of the wound* The use of saline irrigations removes bone dust, clots, and loose fat and tends to promote per primam healing. It also demonstrates oozing points which may require attention.

*Control of bleeding* This is very important before closure. Every bleeding point should be meticulously controlled with ligature or coagulation. The time spent in this step may be long and the task tedious, but the operator will be rewarded by an increased percentage of clean trouble-free wounds which heal per primam. An extra half hour grudgingly devoted to this chore, when required, is a small price indeed when compared to the weeks and often months of painful time-consuming dressings which healing by secondary intention often entails.

*Closure* In our early cases, closure was effected with interrupted silk which passed through skin and subcutaneous tissues, every other stitch being left untied to allow for drainage. Loose sutures being drawn tight on the third or fourth day. It was soon found, however, that drainage passed through the openings left at the apex only and that it was unnecessary to leave openings for drainage in the lateral arms of the incision. Before any sutures are placed, the fit of the flaps is checked with towel clips and excess skin, if present, is excised. It is rarely necessary to alter the skin flaps if they are carefully planned. Beginning at the most proximal portions of the lateral arms, the approximation sutures of No. 1 Deknatel silk are then passed through skin and subcutaneous tissues until the region of the apex is reached. In this area, the sutures are placed as usual, but every other stitch is left loose and knotted at the ends for a distance of about 3 centimeters on each side of the midline. This procedure allows any retained blood or fluid to escape during the first few days. As soon as the drainage stops, the remaining sutures are tied. Drainage material is never used.

*Dressing* A well executed operation may be spoiled by an unsatisfactory dressing. Additional pressure pads are placed so as to obliterate the "hamstring pouch" posteriorly. The remainder of the stump is enclosed in cotton abdominal pads held in place with a snugly fitting gauze bandage. Over this bias-cut stockinette is applied so as to give firm and even pressure to the entire stump. The pressure should be firm enough to eliminate dead space and control capillary bleeding but not enough to interfere with the circulation of the tissues. The actual application of the proper pressure is a matter of experience. In applying the bandages rotation of the soft tissues of the stump should be guarded against. Splints interfere with the retraction of the posterior flap and with the movement of the stump and are therefore not used.

*Postoperative care* As soon as the anesthesia has worn off the patient is encouraged to move the stump. The stump rests horizontally on the bed and is not raised on a pillow for fear of causing flexion contractures. He is

encouraged to walk with crutches as soon as possible usually on the first or second day. The stitches in the lateral arms of the wound may be removed on the fifth day but those at the apex should be left until the twelfth or fourteenth day. The hamstring pull is sometimes strong enough to cause strain on the suture line at the apex and the additional support afforded by the sutures is advisable until the union of the skin and subcutaneous tissues is sufficiently firm.

*Anesthesia* In almost all of our patients low thigh amputation has been done under low subarachnoid block. This anesthetic causes little or no disturbance of the blood pressure since only the vasomotors of the lower extremities and the saddle area are affected. The simultaneous paralysis of the vasoconstrictors to the legs allows the fullest possible vasodilatation. Premedication with morphine, scopolamine and nembutal acts to minimize psychic trauma. The majority of the patients sleep through the procedure. The only possible trauma is psychic due to the noise of the saw since the subarachnoid block isolates the site of operation from any sensory connection with the cerebrum; most of the patients have no memory of the operation itself. The risk of low subarachnoid block is so slight and the results so gratifying that it leaves little to be desired.

The author is fully aware of the use of refrigeration as a method of limb anesthesia. The concept was advanced early in the development of refrigeration that tissues thus cooled were merely in a state of suspended animation or hibernation that all physiological processes came to a standstill and that the tissues when allowed to return to normal temperatures resumed their functions uninjured and unchanged. The experimental work of Large and Heinbecker (7,8,9), Bruneau and Heinbecker, Brooks and Duncan however showed without question that refrigeration causes definite injury to tissues. In most instances of refrigeration anesthesia a tourniquet is necessary above the site of amputation. The operation is therefore done through tissues which have been subjected to circulatory arrest plus refrigeration—two conditions which diminish the local resistance to infection and

retard the healing process. That these complications may occur is attested to by clinical reports of slough of tissues distal to the tourniquet.

When there is a necessity for delay in amputation either because of some general condition of the patient which makes waiting advisable or because of spreading infection and toxemia from the affected member refrigeration is without question a valuable procedure. The author fully agrees with the tenets advanced by writers already quoted which include the following conditions for the use of refrigeration: (1) there must be a necessity for delay in amputation; (2) the tissues to be refrigerated are hopelessly diseased and their removal is mandatory—viable or potentially viable tissues are not refrigerated; (3) the tourniquet is placed immediately proximal to the lesion and is not thereafter disturbed; (4) when amputation is performed the tourniquet is left in place but the operation is done under subarachnoid block or some other form of anesthesia through nonrefrigerated tissues.

The technique of atraumatic low thigh amputation as now performed by the author has been developed over a period of 11 years and has proved itself a highly desirable operation. It is applicable to diseases of the peripheral arteries as well as to any other condition requiring low thigh amputation in which the tissues about the low thigh knee and upper leg are not traumatized nor inflamed. It causes little or no shock, has an extremely low mortality and results in a stump which meets the approval alike of patient, surgeon and limb maker. The stump is mobile, painless, end bearing and its conical shape lends itself well to the prosthesis. The shrinking process proceeds rapidly. Phantom limb sensations are present in every patient but in none have they been a source of unusual annoyance. None of the amputees have had painful stump syndrome or symptoms suggesting neuroma formation.

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# AN EXPERIMENTAL APPROACH TO THE PROBLEM OF INCREASING THE BLOOD SUPPLY TO THE LUNGS

## Preliminary Observations on the Use of Plastics

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A CONSIDERABLE impetus to the study of congenital cardiac defects has resulted from the work of Blalock and his associates. This group has shown that relief of cyanosis and improvement in exercise tolerance may be obtained in a substantial proportion of patients exhibiting the tetralogy of Fallot by the construction of a vascular shunt from a large systemic artery to one of the pulmonary arteries. The modification proposed by Potts consisting of an anastomosis between the aorta and a pulmonary artery is an additional development of the same principle.

An investigation was undertaken in this laboratory of the possibility of employing a more central approach to the problem of increasing the blood supply to the lungs. Attention was focused on the right side of the heart in an effort to devise a method which would avoid the creation of an artificial arteriovenous communication. Two avenues of approach were explored: (1) circumvention of the pulmonary valve by a shunt from the right ventricle to the proximal portion of the main pulmonary artery and (2) dilatation of the pulmonary valve ring.

### EXPERIMENTAL DATA

*1. Intubation of the right ventricle and the pulmonary artery by-passing pulmonary valve.* Polyethylene tubing was selected as the most promising of the available materials. As demonstrated by Ingraham, Alexander and Matson, polyethylene is a plastic substance characterized by lightness, malleability, flexibility, ease of adjustment and ease of sterilization. It is chemically inert and nonirritant.

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ing to living tissues. When the flow of a sufficient volume of blood is maintained, clotting may be avoided for a considerable period of time. Practical application of this property has been made by Myers in intravenous therapy and by Diamond and Thomas for replacement transfusions in the treatment of severe erythroblastosis fetalis. Hackworth reported replacement of the thoracic aorta in dogs.

The operations were performed on cats weighing about 10 pounds and anesthetized by sodium pentobarbital administered intraperitoneally. Controlled rhythmic inflation of the lungs was maintained by air delivered under positive pressure through an intratracheal tube. The left pleural cavity was entered through a left parasternal incision with division of the 3rd, 4th and 5th costal cartilages. The pericardium was incised anterior to the phrenic nerve and the pericardial flaps held apart by traction sutures (Fig. 1a). Two vertical parallel hemostatic sutures of fine silk were placed in the anterior wall of the right ventricle and 2 similar sutures in the anterior wall of the pulmonary artery a short distance above the valve ring (Fig. 1b). In the later experiments a pursestring suture was also placed between the hemostatic sutures in the pulmonary artery. Two anchoring sutures previously placed in the wall of the longer arm of the prebent polyethylene tube were passed horizontally between the hemostatic sutures in the pulmonary artery. An oblique incision was made in the square marked out by the 4 sutures; the end of the tube inserted into the lumen of the pulmonary artery and the hemostatic sutures tied to each other. The pursestring suture was secured and each anchoring suture tied (Fig. 1c). The ventricular end of the tube was inserted by a similar technique (Fig. 1d). The location of the ends of the tube viewed from within the heart may be



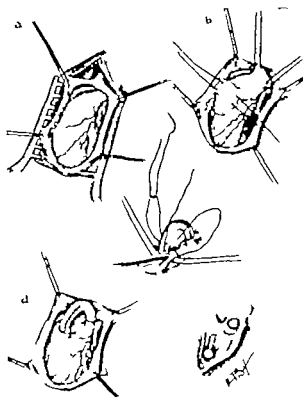


Fig. 1. Circumvention of the pulmonary valve by a polyethylene tube passing from the right ventricle to the pulmonary artery. a, Exposure of the right ventricle and pulmonary artery. The pericardial flaps are held apart by traction sutures. The edge of the left auricle is seen just above the anterior descending coronary artery. b, Two hemostatic sutures have been placed in the right ventricle and the pulmonary artery. c, The pulmonary end of the tube has been inserted into the ventricle and is in position to be placed. Note the anchoring sutures in the wall of the tube. d, The circumventing pulmonary valve. e, Post-mortem specimen, showing one end of the tube in the lumen of the right ventricle and the other end in the pulmonary artery just above valve cusp.

seen in Figure 1 e drawn from the postmortem findings in cat 20. The pericardium was not sutured, and the wound was closed in layers air being removed from the pleural cavity by suction through a catheter during the closure.

The results obtained in this series of operations were as follows. Of the 11 animals explored the intubation was completed in 3. Three cats died during attempted implantation of the tube due to hemorrhage or other technical difficulties. Operation in 5 instances was terminated by suture of the incision in the pulmonary artery following failure properly to insert the tube. At postmortem examination performed subsequently in the course

of other experiments there was no evidence of narrowing of the lumen of the pulmonary artery or of thrombus formation at site of suture.

The 3 cats in whom circumvention of the pulmonary valve was completed provided material for subsequent observations. One animal died 12 hours postoperatively and the other 2 were sacrificed on the 36th and 47th postoperative days respectively. In no instance was there noted any displacement of the ends of the tubes from their location at the time of operation. In every case the lumen of the tube was occupied by a partially organized adherent thrombus, so that it was not possible to estimate how long the flow of blood through the tube observed at operation, had been maintained. The reaction around the outer walls of the tubes consisted for the most part of a thin fibrous membrane.

2. *Dilatation of the pulmonary valve.* The need for a light, nonirritating prosthesis which could be inserted into the pulmonary valve ring and left *in situ* was met by the use of lucite. Intubation of the aorta of dogs with lucite tubes was reported by Hufnagel, who found no thrombosis after several months of observation. In our experience freedom from clot has been dependent on a highly polished, absolutely smooth inner surface.

The final shape of the lucite tubes employed for dilatation of the pulmonary valve is seen in Figure 2. The tube is slightly tapered, and the leading edge bears 2 shallow circular grooves on its outer surface for greater purchase. A flange 1 millimeter in width around the following end of the tube was designed to impede expulsion of the tube through the valve ring. The technical problem of controlling the position of the tube during its insertion through an incision in the anterior wall of the right ventricle was overcome by modifying an ordinary dura clip forceps so that the ends were splayed slightly outward. A hook tube fitted over the tips of such an instrument may be held snugly without slipping off or sliding back on handles of forceps.

The surgical approach to the right ventricle was the same as that employed in the previous experiments and the same exposure was obtained. Two parallel rows of hemostatic sutures were placed in the anterior wall of the

right ventricle each row consisted of 3 sutures (Fig 2 a). An incision was made through the wall of the right ventricle between the rows of sutures and the end of the inserter armed with the lucite prosthesis was introduced to the region of the pulmonary valve. The inserter was disengaged and withdrawn, hemostasis was effected by tying the parallel sutures (Fig 2 b). The location of the prosthesis was confirmed by palpation and the pericardial flaps were loosely approximated leaving room for drainage into the right pleural cavity. Closure of the chest wall was performed in the manner already described.

This procedure was attempted in 8 animals with 3 deaths either during operation or within a few hours thereof; these fatalities were ascribed to acute blood loss. In the remaining 5 cats the tube was successfully inserted within the pulmonary valve ring. The survival times ranged from 8 hours to 5 months. In 2 instances there had been no postoperative displacement of the tube; the second cat died on the ninth postoperative day. In 1 animal the tube was found in the lumen of the right ventricle and had obviously been too large a tube for the particular cat. Autopsy on the 2 remaining animals showed migration of the tube to the bifurcation of the pulmonary artery in one instance, and to the hilus of the right lung in the second case. The lumen of each of the tubes contained a small thrombus not completely occluding the prosthesis. There was no thrombus formation on the endothelium in contact with the tubes; moderate infiltration of the vessel walls with lymphocytes was seen.

#### DISCUSSION

Jeger has described early unsuccessful attempts at the construction of vascular shunts by passing cardiac valves. The survival of animals in the present study, following the insertion of a polyethylene tube circumventing the pulmonary valve, provides a basis for an experimental program extending these observations. The occurrence of clotting within the prostheses was not unexpected as there was no obligatory flow of blood through the tubes. Since the degree of clotting is a function both of the size of the lumen of the tube and of the volume of blood flow, both of these factors

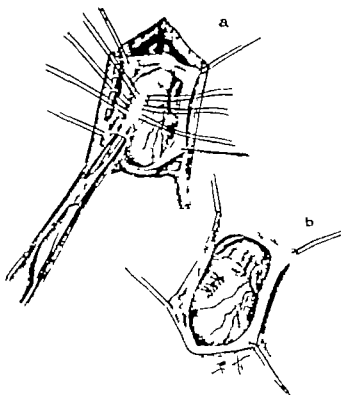


Fig. 2. Insertion of a lucite tube for dilatation of the pulmonary valve. a, Same exposure as in Figure 1. Two parallel rows of hemostatic sutures have been placed in the anterior wall of the right ventricle. The inserter is armed with the lucite tube. The dotted line indicates the proposed site of the myocardial incision through which the tube will be inserted. b, Showing the lucite tube inserted at the site of the pulmonary valve. The incision in the myocardium has been closed by tying the hemostatic sutures.

could be evaluated further by the use of larger tubes in dogs and by ligating the pulmonary artery within the by-passed area. By these maneuvers in addition to survival and non-displacement of the tube a shunt might be established that would remain patent and provide a tool for the study of vascular physiology and pathology. A similar technique could be applied to other chambers of the heart.

Survival following dilatation of stenosed valves in humans has been described by Tuffier and by Souttar. In these patients the aortic and mitral valves respectively were dilated by invagination of the vessel wall through the valve lumen over the finger of the operator. In the present investigation an attempt was made to insert a prosthesis that would maintain the valve in a dilated state. It has proved more difficult to keep such a tube from being dislocated than was the case with the by-pass procedure. However with further refinements in technique a greater

degree of success has been obtained. Work is now in progress on the construction of a lucite prosthesis containing a valve to eliminate free pulmonary insufficiency. The application of the venous catheterization technique to animals in which such prostheses have been inserted might prove of value in the study of altered cardiac physiology and dynamics.

In the course of this study it was considered that a prosthesis either circumventing or dilating a cardiac valve should have a diameter conforming to that of the normal valve. In order to determine the average dimensions of the pulmonary valve in children the pertinent data from an extensive series of autopsy protocols were subjected to statistical analysis. It was found that the average diameter of the pulmonary valve varies only 1 millimeter between the ages of 2 and 7 years. The optimum diameter for a prosthesis intended to bypass or dilate the pulmonary valve in children of this age group should be about 14 millimeters.

The assumption has been generally accepted that the lesion responsible for the decreased flow of blood to the lungs in patients with the tetralogy of Fallot would not be amenable to local dilatation. It is well known that many of these individuals succumb within a few months of birth of a combination of cardiac lesions that is incompatible with survival. An impression was tentatively entertained that with the elimination of the patients presenting the most serious defects the surviving children might present a situation more favorable for direct surgical dilatation. An analysis of the autopsy material in this laboratory establishes the fact that such is not the case. There is no single stenotic or atretic lesion responsible for the hypoxemia associated with the tetralogy of Fallot but rather a combination of defects. Among the unpredictable variables in a given case are the degree of prominence of the crista supraventricularis, the status of the valve ring, the condition of the valve cusps, the size and location of the septal defect, rigidity of the base of the pulmonary artery, and extent and degree of atresia of the pulmonary artery.

While this would seem effectively to preclude any attempt at local dilatation of the pulmonary valve the circumvention type of procedure still merits consideration. The use of

a substance such as polyethylene tubing permits alteration in the ultimate shape of the prosthesis to conform to a given situation. It is not implied at this time that a technique such as this has been developed sufficiently to justify application in human material. Among other theoretical objections is the feature of a foreign body with a lumen of fixed size in a growing organ. Also as emphasized by Elliot Cutler any abrupt change in cardiac dynamics such as would be caused by this type of procedure might entail serious side effects. It is however suggested that this approach merits further development in the study of the dynamics and therapy of cardiac lesions.

#### SUMMARY

1. A technique has been described for the insertion of prostheses circumventing and dilating the pulmonary valve.

2. The properties of polyethylene and lucite have been described.

3. It is suggested that this approach may be useful in reproducing the effects of valvular insufficiency and in the study of the altered physiology and dynamics of cardiac lesions. A tentative program is proposed.

4. The possible application of this method to provide an increased blood supply to the lungs in the face of pulmonary stenosis is discussed.

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# CELIAC SYNDROME

## VII Therapy of Meconium Ileus Report of Eight Cases with a Review of the Literature

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THE association of meconium ileus with pancreatic cystic fibrosis was first described by Landsteiner in 1905. Since then there have been 11 other cases reported (3-5, 8-11, 14-16, 18) in each of which meconium ileus has been noted at operation and fibrocystic disease of the pancreas described following autopsy. Thus the coexistence of these two conditions has been well established. Seven additional cases have been found in the pathological records of the Babies Hospital.

Two hypotheses have been suggested to explain the association of abnormal meconium and fibrocystic disease of the pancreas. The first, advanced by Landsteiner, regards the abnormal meconium as primary and the changes in the pancreas as the result of intestinal obstruction; the second considers the changes in the pancreas as primary and the abnormality of the meconium as the consequence of lack of normal digestion of the meconium by pancreatic secretions. The latter view, which is generally held at present, has been strongly supported by the studies of Farber (6, 7).

Farber investigated the altered physical state of meconium in infants with meconium ileus. The meconium was so sticky and mucilaginous in consistency that the fingers and instruments were not easily extricated from the meconium after contact. The bowel is not able to propel this abnormal material and so the meconium becomes responsible for the intestinal obstruction. In vitro experiments by Farber showed that when this abnormal material was placed in contact with saline solutions of pancreatin (1 to 10%) at 37.5 degrees C. it was quickly reduced to a semiliquid or

liquid state. This observation provides the chief evidence for the view that the lack of pancreatic enzymes is the main factor responsible for meconium ileus.

It is obvious from a review of the literature as well as from our own experience that there are all variations and degrees of obstruction due to abnormal meconium in patients with cystic fibrosis of the pancreas. Many such patients have no obstruction at all. Some have transient meconium plugs which are passed following mild obstructive symptoms. Occasionally such a case responds to the instillation of pancreatin into the exposed gut at operation or to simple massaging of the meconium on into the large intestine. Farber has reported 4 cases in which the obstruction was relieved by the instillation of a 1 per cent pancreatin solution through an enterostomy opening. However, death occurred several days to a few weeks after the instillation from intercurrent infection.

We wish to emphasize that in this paper we are concerned with meconium ileus of the most severe form in which in our judgment it was inconceivable that the obstruction could be relieved by any of the above described conservative measures. The actual pathologic findings and surgical technique will be described in detail.

Hurwitt and Arnheim, in 1942, reviewed the literature and were unable to find any instances of recovery. Swenson and Ladd, discussing this condition in November 1945, state:

This disease caused by pancreatic insufficiency is uniformly fatal. They reported that they were able to clear the intestinal tract using pancreatic solutions through an enterostomy, but that death resulted from pulmonary infections within a short time.

Table I summarizes all of the known reports and 15 unreported cases through Sep-

From the Babies Hospital, New York, and the Department of Pediatrics, Columbia University College of Physicians and Surgeons, New York.



gical service of the Babies Hospital on September 6, 1945 because of failure to pass meconium since birth associated with the development of distention and vomiting of green material. The pregnancy had been uneventful and the family history was negative. The baby appeared well developed and well nourished with a markedly distended abdomen—30.5 centimeters in circumference. The rectum admitted the examining finger but was empty and small. A ray examination of the abdomen at this time revealed a moderate small gut distention confined for the most part to the left abdomen. The right abdomen was free except for one single distended loop seen in all films. A lipidol enema showed a small but essentially normal colon. The diagnosis entertained at the time was small gut obstruction due to atresia, stenosis or volvulus of the ileum. In consequence the abdomen was opened and a volvulus of a loop of ileum was found which on further examination appeared to be secondary to a meconium ileus. The volvulus was reduced and the abnormal meconium completely removed through a small ileotomy by a technique to be described later. The ileotomy was closed the bowel was replaced and the abdomen closed without drainage.

For the first four postoperative days the baby's course was rather stormy and she was maintained on parenteral fluids. Nasogastric suction was carried out during this period. On the second postoperative day a small amount of meconium was passed per rectum and from then on the baby had stools at normal intervals. Water was given by mouth on the fourth postoperative day and a day later an evaporated milk formula (1:3 plus 5 per cent cane sugar) was started. Pancreatin in 5 per cent solution was administered through the nasogastric tube until the baby was taking food per os. Pancreatin was then given per os in doses of 0.5 gram with each feeding a total of 3.0 grams daily.

Duodenal drainage was performed at the end of the third week in the hospital. Analysis revealed a tryptic activity of 2.0 units per cubic centimeter (the normal is 100 plus) confirming the diagnosis of cystic fibrosis of the pancreas associated with meconium ileus. At this time (at 3 weeks of age) the diet was changed to a formula containing protein milk powder 60 grams, glucose 30 grams, casein hydrolysate 6 grams, and water to make 720 cubic centimeters. The following vitamin supplements were also given: B complex 2 cubic centimeters twice daily, oleum percomorphum 12 drops once a day, ascorbic acid 50 milligrams once a day, and pancreatin was continued at a dose of 3.0 grams daily (0.5 grams per feeding or bottle).

Intramuscular penicillin was administered for the first 3 weeks to control infection. Sulfadiazine in prophylactic doses (0.1 gm. twice daily) was given for the remainder of the hospital stay.

The baby gained 400 grams in the first 3 weeks and after being changed to a protein milk formula continued to do well. She was discharged on the 52nd hospital day weighing 3,830 grams. She has been

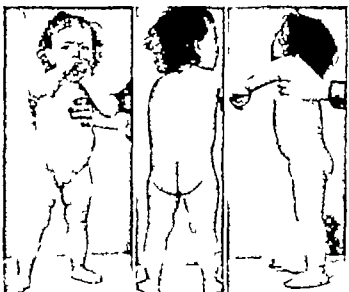
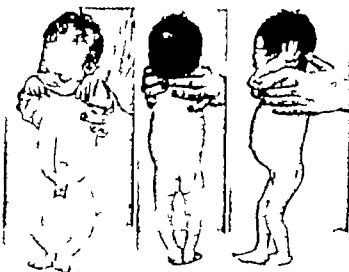


Fig 1 a, Case 1 C F, at 1 month of age b at 15 months of age.

followed since in the out patient department and at the age of 26 months measured 80 centimeters in length and weighed 12,870 grams. Except for an occasional transitory upper respiratory infection she has had no difficulties (Fig 1).

CASE 2 C B A white female infant was born on the Sloane Maternity service of the Presbyterian Hospital on September 13, 1945 weighing 3,510 grams. Pregnancy and labor were uneventful. One year previously the mother had given birth to an apparently normal male infant who soon after birth developed signs of intestinal obstruction and at autopsy was found to have meconium ileus associated with cystic fibrosis of the pancreas.

During the first 24 hours the baby appeared well but did not pass meconium and regurgitated the glucose taken by mouth. At 18 hours after delivery

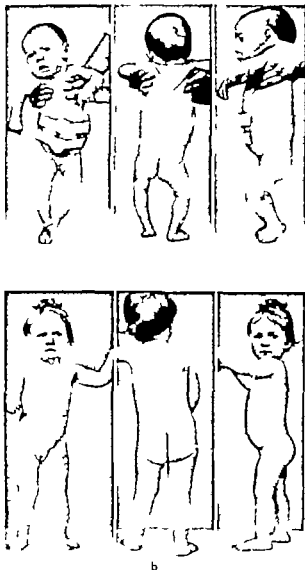


Fig. 3. a, Case C B t 3 months of age; b, at 6 months of age.

there were palpable distended loops of gut in the lower abdomen and in the next 4 hours, the abdominal circumference increased from 33 to 37 centimeters. Rectal examination at this time revealed a small empty rectum.

The infant was transferred to the Babies Hospital. Nasogastric suction was started and parenteral fluids were administered. A roentgenogram of the abdomen on the following day showed loops of distended gut in the left upper quadrant. A diagnosis of intestinal obstruction probably due to meconium ileus was made and laparotomy was performed. Large dilated purple-hued loops of ileum contained in passated meconium. Through an enterotomy wound the gut was completely freed of this material.

Before closing the enterotomy 10 or 15 cubic centimeters of 5 per cent pancreatin in water was instilled into the ileum. The abdomen was closed about drainage. Parenteral fluids, nasogastric suction and general supportive measures, including blood and plasma infusions, were instituted immediately. For a few days there was a little relief of the abdominal distention, but on the third postoperative day meconium began to pass per rectum, and the baby had normal stools. Pancreatin was given every 4 hours like the nasogastric tube was in place, and the tube was clamped for 1 hour after each instillation. Upon removal of the tube pancreatin was continued per se and the baby started on karo water. On the fifth postoperative day an evaporated milk formula was begun. Duodenal drainage done on the tenth postoperative day revealed less than 1.4 units per centimeter of tryptic activity. This confirmed the diagnosis of cystic fibrosis of the pancreas associated with meconium ileus in this child and the diet was changed to protein milk powder 40 grams, glucose 10 grams, casein hydrolylate 6 grams, after to 10 cubic centimeters. Vitamin supplements and pancreatin were given as in the preceding case and continued after discharge. At 8 weeks the diet was again changed to hi pro 85 grams, glucose 30 grams, casein hydrolylate 10 grams, and water to 600 cubic centimeters. At 10 weeks of age egg yolk and strained string beans were added to the diet—one serving of each daily.

The remainder of the hospital stay showed a general improvement. On two occasions, the infant had episodes much like celiac crises which were marked by an increase in the number of stools, a sudden weight loss and vomiting. These episodes responded rapidly to administration of parenteral fluids and plasma. Penicillin was given for the first 2½ weeks, and again for 2 weeks when an upper respiratory infection was present. During the last 17 days, sulfadiazine was given as a prophylactic measure (0.1 per twice daily).

Since discharge she has been followed in the outpatient department. She has had two additional admissions to the Babies Hospital for the treatment of bronchopneumonia—the first at about 9 months of age and the second at about 18 months. Both illnesses responded well to sulfadiazine given orally and to penicillin by aerosolization.

In spite of these two episodes she has grown well and gained regularly and now at 20 months of age, weighs 10,000 grams and measures 80 centimeters in length (Fig. 3).

CASE 3. A. F. A white male infant was admitted on August 18, 1946 at 10 hours of age after a normal delivery at another hospital. No abnormalities were noted at birth. He began to vomit bile-stained material within the first 4 hours and continued to do so until admission. No meconium was passed per rectum. A sibling had died 1 year previously with a similar clinical picture and was found at a topography similar to that of the present case.

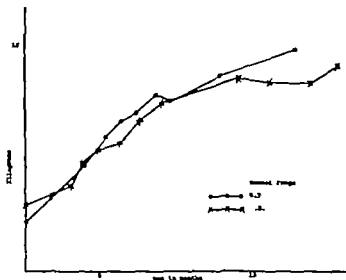


Fig. 3. Weight curves of Cases 1 and 2 compared with the normal mean.

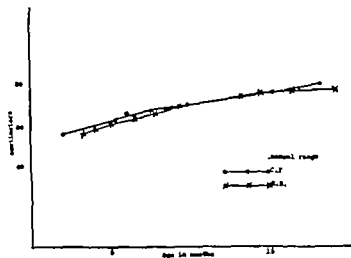


Fig. 4. Height curves of Cases 1 and 2 compared with the normal mean.

Examination revealed a tense, distended abdomen and an empty hypoplastic rectum. Crepitation could be elicited in the left upper quadrant of the abdomen and a large mass could be appreciated running transversely across the abdomen. Three position roentgenograms revealed dilated upper small gut loops containing fluid levels. Because of the history of meconium ileus in the sibling and the above findings a diagnosis of meconium ileus was made. The operation was performed 30 hours after birth. The 20 hour preoperative period in the hospital was used for hydration and tube suction of the stomach.

The operation was performed through a right rectus incision and the diagnosis of meconium ileus was confirmed. The mass and crepitation noted on physical examination were due to a tremendously hypertrophied and dilated loop of upper ileum which had undergone a 360 degree volvulus and was gangrenous, but not yet perforated. This was resected and the remaining meconium completely removed by saline irrigation through a No. 16 catheter utilizing a pursestring suture around each of the cut ends of the gut. When the gut was completely empty of meconium, an end-to-end anastomosis was performed an inner layer of continuous No. 000 and an outer serous layer of interrupted No. 0000 silk being used. The operative wound was closed in layers without drainage.

Summary of surgical pathology report. The specimen is a greatly dilated segment of small bowel 40 centimeters in length with a maximal diameter of 5 centimeters proximal to the site of a contracting twist of the gut. Microscopic examination shows early gangrene of the dilated portion.

Postoperatively the child was put in an incubator equipped for oxygen administration gastric suction was maintained and supportive treatment with saline, plasma, and blood was given. Penicillin (10,000 units) was given intramuscularly every 3 hours and 0.5 gram of pancreatin in solution was in-

stilled through the nasogastric tube and the tube clamped for 1 hour after each instillation. The child began to have bowel movements on the third postoperative day and was started on karo water on the fourth postoperative day. This was supplanted by formula on the sixth postoperative day. For the rest of his hospital stay the child received vitamins A, D and B complex and pancreatin 3 grams once a day. Sulfadiazine was started on the eighteenth postoperative day because of a few pulmonary rhonchi and continued until the time of discharge. On the ninth postoperative day a high protein formula for fibrocystic disease of the pancreas was initiated. The wound healed per primam. A duodenal drainage was done on the twenty-ninth postoperative day revealing only 5 units per cubic centimeter of trypsin in the duodenal secretions.

The child was discharged on the thirty-second postoperative day slowly gaining weight and free of pulmonary symptoms. He is being maintained at home on a high protein, high carbohydrate, low fat diet, and pancreatin. He was last seen on October 4, 1946, with a cough but no râles could be heard and the chest was clear on fluoroscopy. On October 22, 1947, he was reported as thriving although he had had several respiratory infections during the preceding year.

CASE 4. B. G. M. A male child 12 hours old was admitted with a history of vomiting bile-stained material shortly after birth and failure to pass meconium by rectum. The abdomen was noted to be distended at birth. Family history revealed that a sibling had died of an intestinal obstruction at 6 days of age. Examination revealed a markedly distended abdomen and an empty collapsed rectum. Roentgenograms revealed dilated upper small gut loops containing fluid levels. Small bubbles of air could be seen more distally. Because of these findings, a preoperative diagnosis of meconium ileus was made.



At operation this diagnosis was confirmed. However there were some marked variations in the pathological findings which could be recognized as diminishing the chances of successful intervention. The degree of hypertrophy of the upper ileum and the lower jejunum was much less than usual and the length of the atrophic ileum was three times what is usually seen. The impression of a more severe form of the disease was obtained. However all the abnormal meconium was removed in the usual manner and the abdomen closed without drainage.

Postoperatively the baby did not have any stools and died after 5 days with progressive distention, circulatory failure, and sclerema. No autopsy was obtained.

**CASE 5 B G C.** A female child 52 hours old was admitted with a history of vomiting and absence of stools since birth. The family history was negative. Examination revealed a baby who appeared dehydrated and feeble with a markedly distended abdomen and a small empty collapsed rectum. The skin had a decidedly ctenic tinge. Roentgenograms showed dilated small gut loops containing fluid levels. We were unable to make a definite diagnosis although meconium ileus was strongly suspected.

After a 9 hour period of hydration and suction of stomach contents, the abdomen was opened and a typical meconium ileus with volvulus was found. The gut was easily cleared of abnormal meconium by the technique to be described and the abdomen closed without drainage.

Postoperatively the child seemed to be doing well but suddenly died at the end of the first postoperative day. Autopsy revealed a profuse peritonitis. Cultures of the meconium removed from the proximal and distal segments of ileum at operation both yielded a pure culture of *Escherichia coli*. Blood cultures before death also yielded *Escherichia coli*. Therefore, the cause of death was judged to be bacteremia and peritonitis due to *Escherichia coli*. Fibrocystic disease of the pancreas was found at autopsy.

**CASE 6 N K.** A white male infant 3 days old was admitted to Babies Hospital because of persistent vomiting and distention since birth and failure to pass meconium per rectum. This child was the result of the second pregnancy in this family, the first ending in a miscarriage. Normal delivery occurred at another hospital.

Examination revealed a moderately dehydrated infant with a distended abdomen and a small empty rectum. Three position films of the abdomen showed dilated upper intestinal loops containing gas and some fluid. The lower abdomen showed only an opaque medium of water density containing occasional minute air bubbles. Because of this roentgen picture and the solid consistency of the abdomen by palpation as well as the small empty rectum, the diagnosis of meconium ileus was made.

Following a three hour period of hydration and nasogastric suction the abdomen was opened through a right rectus incision. In addition to meconium ileus

the patient had a 360 degree volvulus of a loop of upper ileum with impairment of circulation, but no appreciable gangrene. The volvulus was reduced and the abnormal meconium removed in the usual manner. The abdomen was closed without drainage.

Postoperatively the baby continued to be distended in spite of nasogastric suction and pancreatin every 6 hours. The stools were very scanty and ceased altogether on the third postoperative day. In spite of penicillin, streptomycin, and general supportive measures, the baby died on the fourth postoperative day.

Autopsy revealed that the probable cause of death was the devitalized loop of ileum that had been involved in the volvulus. It had remained devitalized and the mucosa was actually gangrenous. There was a marked peritoneal reaction around this loop. Cystic fibrosis of the pancreas was also confirmed at autopsy.

**CASE 7 J H M.** A male infant of 3 days was admitted with a history of vomiting and progressive distention since birth. Delivery was normal. The family history was negative with respect to pancreatic deficiency.

Examination revealed a moderately dehydrated infant with a hard distended abdomen and a small empty rectum. Roentgenograms showed dilated loops of intestine with air fluid levels.

After 3 hours of nasogastric suction and hydration the patient was operated upon through a right rectus incision and a meconium ileus was found. There was no volvulus. The abnormal meconium was evacuated and the abdomen closed without drainage. Three grams of pancreatin in 4 milliliters of saline was inserted into the gut before closing the enterotomy.

The usual postoperative regimen of nasogastric suction, pancreatin saline plasma and penicillin was carried out and the course was uneventful. Bowel movements began on the first postoperative day and feeding was started on the third postoperative day. The wound healed per primam. Duodenal drainage revealed only 1.4 units per cubic centimeter of trypsin in the duodenal fluid.

The patient was discharged from the hospital on the 39th postoperative day on a high caloric, high protein low fat formula with 3 grams of pancreatin once daily.

No difficulties have been encountered during the 3 1/2 month period to the present.

**CASE 8 P C.** A white male infant was first seen at 24 hours of age with a history of persistent vomiting and increasing abdominal distention since birth. Normal delivery occurred at another hospital. The family history was noncontributory.

Examination revealed a moderately dehydrated baby with a markedly distended hard abdomen. Large, dilated, nontympanic loops of intestine could be palpated through the abdominal wall. The rectum was small and empty. Roentgenograms showed dilated upper intestinal loops filled with gas and fluid. No gas was seen in the rectum or colon.

After 4 hours of hydration and nasogastric suction the patient was taken to the operating room and the abdomen was opened through a right rectus incision. A typical meconium ileus was found with a mild volvulus in the upper ileum without circulatory impairment. The volvulus was reduced and the abnormal meconium removed in the usual fashion through an enterotomy. Three grams of pancreatin in 40 milliliters of saline was instilled before closing the enterotomy.

The postoperative course was uneventful. The infant began having bowel movements on the first postoperative day. The postoperative regimen included nasogastric suction with instillation of pancreatin every 6 hours penicillin streptomycin saline and plasma. Nasogastric suction was discontinued on the third postoperative day and feedings were begun. Trypsin was found to be almost absent from the duodenal juice in the third postoperative week.

In the 2 months following discharge, the patient did not do well because of recurrent pulmonary difficulties. At the time of preparation of this paper he was again in the hospital with a severe bilateral pneumonia for which tracheotomy was performed to facilitate suction of the bronchial tree. He died at the age of 3 months. Postmortem examination confirmed the diagnosis of cystic fibrosis of the pancreas. The ileum and colon were of normal dimensions throughout.

In reviewing these 8 cases we emphasize the fact that combined surgical and medical treatment is necessary. The literature reveals that the few cases of meconium ileus which have been successfully treated surgically have succumbed to subsequent respiratory complications of the type usually associated with pancreatic insufficiency resulting from cystic fibrosis.

Since the recognition of this syndrome in 1905 the longest reported postoperative survivals have been a few weeks or months. Our Cases 1, 2, 3, and 7 represent the first successful results to be reported.

#### SURGICAL CONSIDERATIONS

The main purpose of the surgical treatment of these patients is the complete removal of the abnormal meconium as quickly and as gently as possible. In order to do this, an accurate understanding of the presenting pathology is necessary. In all these cases approximately the distal half of the small gut is filled with abnormal material. This varies from semiliquid to extremely tenacious meconium in the lower jejunum and upper ileum and be-

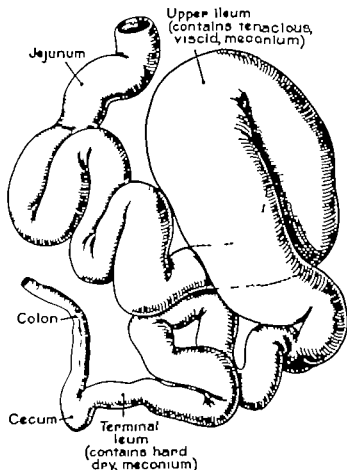


Fig. 5 The external appearance of the intestine in typical meconium ileus.

comes gradually more desiccated in the more distal loops so that a segment of the terminal ileum which varies in length from 20 to 40 centimeters is filled with actual concretions. The concretions are hard greyish white and they make a perfect cast of the inside of the ileum.

The most striking abnormality is the hypertrophy and dilatation of the mid-ileum. This hypertrophy and dilatation begins usually in the lower jejunum and becomes maximal in the mid ileum and ends 20 to 40 centimeters from the ileocecal valve. The transition from the dilated portion of the ileum where the meconium is semifluid to the small thin walled terminal ileal segment containing the above described concretions is sometimes abrupt. The area of maximum hypertrophy and dilatation in the mid ileum will often measure 7 centimeters in diameter while the terminal segment averages approximately 1.5 centimeters in diameter. The large intestine in each case in the series was found to be empty, small and hypoplastic.



od between birth and operation was 52 hours death was due to *Escherichia coli* peritonitis and septicemia the presence of this organism in the gastrointestinal tract within 2½ days of the time of birth was further confirmed by cultures of the meconium at operation. A certain period of observation is necessary to rule out the possibility of transient meconium plugs causing temporary obstruction. It also allows time for decompression of the stomach with a tube under constant suction and the correction of the disturbed water and electrolyte balance. The decision for operative intervention at the end of this time depends upon the absence of gas in the colon as seen by roentgenogram. In the presence of colonic gas further delay is justified.

Another very important consideration in these cases is the association of meconium ileus with volvulus. Because of the tremendous hypertrophy and elongation of the small gut before birth in this disease it is a common experience to find a loop twisted upon itself resembling a volvulus. There is one important difference however in that the gut wall in the involved loop is markedly hypertrophied a fact which indicates to the surgeon that the primary pathology is more distal. The presence of this phenomenon was observed in 5 of our patients.

In evaluating the causes of death in the 3 infants who did not survive the postoperative period we find that one had a very severe form of the disease with an unusually long hypoplastic segment of terminal ileum and minimal hypertrophy proximal to this. The 2 other deaths we feel certain were due to our failure to resect devitalized gut that had been involved in a volvulus. The demands on this gut in the postoperative period to propel material through underdeveloped terminal ileum and colon require that it be healthy. By devitalization we mean any loop that appears to have lost its full powers of peristalsis. Since the terminal ileum and entire colon are very thin walled and approximately the size of an ordinary lead pencil most of the propulsive power must come from the hypertrophied small gut proximal to this. If a loop with poor peristaltic power is allowed to remain it will inevitably prove fatal to the patient. In Case

3 in which the loop of gut involved in the volvulus was actually gangrenous resection plus removal of abnormal meconium was quite successful.

The three most important surgical principles to be kept in mind are (1) complete evacuation of abnormal meconium (2) appreciation of the fact that meconium ileus may be the underlying cause of a volvulus in the neonatal period and (3) resection of all devitalized gut.

#### MEDICAL MANAGEMENT

The reports of Andersen (1, 2) indicate that the earlier the diagnosis of pancreatic insufficiency is made the better is the prognosis for prevention of respiratory disease and for survival. The outlook is best if the diagnosis can be made and proper therapy commenced before the onset of respiratory disease.

In the 4 surviving infants operated upon at Babies Hospital the diagnosis of pancreatic fibrosis was suspected from the first because of the findings at operation. As soon as the condition of the infants allowed duodenal drainage was performed and analysis of the secretions for trypsin carried out. The results indicated the presence of pancreatic insufficiency in all cases confirming the diagnosis of cystic fibrosis of the pancreas.

Because of the previously known association of meconium ileus with cystic fibrosis of the pancreas the dietary changes advocated by Andersen were instituted even before confirmation of diagnosis had been obtained by demonstration of low trypsin activity in duodenal juice. All patients were started on a protein milk formula fortified with glucose and casein hydrolyzates the exact composition of the diet for each child is described in the case reports. Later hipro was substituted for protein milk although the latter could well have been continued. Since discharge from the hospital various additions have been made to the diets and at present each child of suitable age is receiving strained fruit juices, pot cheese, fruits, vegetables, jello, junket, etc., and meat (boiled, broiled or roasted with all visible fat removed). The formulae are continued with the proportions of milk and sample 1 as increased to bring the caloric value up to the individual child's requirement (Table II).



sis of meconium ileus in a newborn infant with intestinal obstruction

5 Five of the 8 patients coming to operation were successfully relieved of intestinal obstruction. The oldest of the survivors is now more than 2 years old. The prognosis of the survivors is dominated by the underlying pancreatic disease.

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# CARCINOMA OF THE BLADDER WITH BONE METASTASES

## A Report of 8 Cases

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THE old idea that bone metastases secondary to carcinoma of the bladder are of rare occurrence seems still to prevail. In a previous communication one of us (H.L.K.) reported 5 cases and called attention to the fact that this condition occurs more frequently than is appreciated, and that it may occur with small papillary tumors that appear to be simple papillomas. As early as 1854, Schraut called attention to the fact that bone metastases do occur in cases of carcinoma of the bladder.

Articles in the older as well as in the recent literature, generally dealt with the report of a single case. The renewed interest in this subject has been followed by articles that deal with a series of cases. Many of these cases are reported by roentgenologists and orthopedists in articles dealing with the general subject of bone metastases and unfortunately contain little or no detailed information. Among the urologists who have reported a series of cases may be mentioned Burkland and Leadbetter Colston and Leadbetter Graves Jewett, Judd, Kretschmer Sutherland, and Turner and Jaffe.

In the older textbooks the subject received scant attention. However some authors, like Geraghty Herman, and Hinman feel that bone metastases are an important and frequent finding. Beer Colston Geschickter Judd Kretschmer Lemaitre, Turner and Jaffe, and many others, are of the opinion that the condition is more common than is generally believed.

The report of the Carcinoma Registry of the American Urological Association in 1934 showed the incidence of bone metastases to be 3.7 per cent of the 902 bladder tumors then recorded. The present paper is based on a series of 8 cases and a review of the literature.

### CASE REPORTS

CASE 1: L. C. M., male, aged 73 years, entered the Presbyterian Hospital on the service of H. L. K.

July 3, 1946. On July 8, 1946 a transurethral resection of the prostate and a bladder tumor was performed by Dr. N. J. Heckel. The pathological examinations revealed benign hypertrophy of the prostate and papillary carcinoma of the bladder. The patient was readmitted to the hospital on October 15, 1946 with the complaint of gross hematuria, with passage of blood clots of 4 days' duration.

Physical examination was essentially negative except for bilateral inguinal hernias. Rectal examination revealed an enlarged prostate grade 1/4, soft and smooth with no signs of carcinoma. The blood count and Kahn test were normal, the nonprotein nitrogen was 53 milligrams per cent and the urinalysis showed albumin 2+ and a grossly bloody urine.

Suprapubic cystostomy was performed on October 26, 1946 (H.L.K.) because of profuse hemorrhage. At operation a large ulcerating tumor located on the right lateral wall was found. The bladder was packed with gauze. Biopsy report stated papillary carcinoma (Fig. 1). Convalescence was uneventful and he was discharged November 16, 1946, with permanent suprapubic catheter drainage.

On June 15, 1947 he developed a painful swelling in the left clavicle. Ten days later in attempting to turn himself he heard a snap in the left clavicle, which was followed by severe pain. His physician made a diagnosis of pathological fracture due to metastatic carcinoma of the clavicle. The patient was bedfast at home and unable to have a roentgen-ray examination but the clinical diagnosis seems perfectly obvious.

CASE 2: L. C. H., male aged 60 years, entered the Presbyterian Hospital on the service of Dr. E. J. Berkheiser. In June, 1948 he underwent elsewhere a partial resection of the bladder for tumor with reimplantation of the left ureter into the bladder. The ureter became obstructed at the site of implantation and a left nephrectomy was done. In January 1949 a transurethral resection of the prostate was done elsewhere. Two months before admission patient developed severe bilateral sacroiliac pain which radiated into the legs. The urinary symptoms were frequency nocturia, dribbling and weakness of the urinary stream.

Physical examination revealed a left lumbar and a suprapubic mass. Severe pain was noted on pressure over the fifth lumbar vertebra. Rectal examination revealed a normal prostate. The blood count was normal. The urinalysis showed albumin 2+ with many red blood and pus cells.

They are indebted to Dr. Theodore J. Smith for notes on the course of the patient's illness after he left the Presbyterian Hospital.

Roentgen ray examination March 15 1943 revealed destruction of the 4th lumbar vertebra and the upper border of the sacrum compatible with metastasis. A second roentgen examination on April 26 1943 revealed destruction of the anterior border of the second and fourth lumbar vertebrae with some compression of the fourth lumbar vertebra compatible with metastasis (Fig. 2).

On April 6 1943 a cordotomy was performed by Dr. A. Verbruggen at the level of the third segment, for the relief of severe pain.

The patient continued his narcotic requirements gradually failed and died on September 30 1943.

Autopsy September 30 1943 revealed a papillary carcinoma of the bladder (Fig. 3) retrograde tumor implantations in the dilated left ureter extensive metastatic carcinoma of the left renal fossa extensive metastatic carcinoma of the lumbar spine (Fig. 4) metastatic carcinoma of the sacrum and lower thoracic vertebrae metastatic carcinoma of the liver lower lobe of right lung pulmonary hilar upper mediastinal and peri iliac lymph nodes.

CASE 3 S. B. female, aged 50 years entered the Presbyterian Hospital on December 31 1945. One year ago she developed hematuria frequency nocturia urgency and dysuria.

Blood examination blood chemistry Wassermann roentgen ray examination and intravenous pyelogram all were negative. The urinalysis showed a trace of albumin and the sediment showed red blood cells. The cystoscopic examination (H. L. K.) revealed five papillary tumors on the floor of the bladder. They were resected and the bases fulgurated. Pathological report showed papillary carcinoma of the bladder (Fig. 5).

The patient re-entered the hospital in June and October 1946 and further resection and fulguration of bladder tumors was carried out.

Operation (H. L. K.) was performed December 16 1946. It consisted of suprapubic cystostomy with wide resection of bladder wall and tumor. Pathological report showed papillary carcinoma of the bladder. Operation for closure of the fistula (H. L. K.) was carried out on January 27 1947.

On March 17 1947 patient complained of pain in her right lower chest. Roentgen ray examination revealed a pathological fracture of the right ninth rib anteriorly (Fig. 6) a compression fracture of the upper border of the third lumbar vertebra and multiple areas of bone destruction involving the pubic bones and the upper end of the right femur compatible with metastases (Fig. 7). A chest film revealed small areas of increased density scattered throughout both lung fields suggesting metastasis.

Deep roentgen ray therapy was instituted. Her convalescence was slow requiring large quantities of narcotics for relief of pain. She was discharged on April 17 1947 and died 3 weeks later. No autopsy was made.

CASE 4. M. T. male aged 58 years entered the Presbyterian Hospital on July 8 1936. In 1934 he underwent elsewhere a transurethral fulguration of



Fig. 1 Case Typical papillary carcinoma of the bladder  $\times 80$

a bladder tumor and a litholapaxy. First admission to the Presbyterian Hospital was in May 1936 when a transurethral resection and fulguration of a bladder tumor was done (H. L. K.). Microscopic report showed papillary carcinoma of the bladder (Fig. 8). One month prior to his present admission patient developed severe pain in the right hip and thigh frequency of urination nocturia attacks of hematuria and severe dysuria.

Physical examination revealed scars over the right upper and lower quadrants. A hard mass fixed to the symphysis pubis extended 4 fingers breadth above the symphysis pubis. Palpation produced severe pain. Enlarged inguinal glands were noted on the right side. The rectal examination was negative.

The blood count was normal. The urinalysis showed 10 000 pus cells per cubic millimeter and 800 erythrocytes per cubic millimeter. Culture of the urine showed *Bacillus coli communis*.

Roentgen ray examination revealed destruction of the right superior and inferior ramus of the pubis with thinning of the left pubis compatible with bone metastases (Fig. 9). The patient was given deep roentgen ray therapy and discharged from the hospital in fair condition on July 13 1936. The patient died 4 months later.





Fig. 1. Case 1. Note destruction of the second and fourth lumbar vertebrae.



Fig. 3. Case 2. Typical papillary carcinoma of the bladder. X40.

CASE 5. M. A. C., male, aged 58 years, entered the Presbyterian Hospital on December 23, 1946. In February, 1946, a transurethral resection with fulguration of bladder papilloma was done (H. L. K.). Biopsy report revealed papillary carcinoma of the bladder (Fig. 10). In May, 1946, and in October, 1946, further transurethral resection and fulguration of bladder papillomas were carried out (H. L. K.). Biopsy report, October, 1946, revealed papillary carcinoma of the bladder with invasion of granulation tissue and smooth muscle.

Four days prior to admission patient developed gross hematuria, frequency, nocturia and dribbling at the end of urination.

Röntgen ray examination, intravenous urograms and blood count were negative. Urinalysis showed 50 red blood cells per cubic millimeter.

Operation (H. L. K.) consisted of transurethral fulguration of an elevated area at the site of previous resection. Patient was discharged in good condition on December 25, 1946.

In the middle of March, 1947, the patient injured her right leg just below the knee. Six weeks later a swelling developed at the site of injury. A roentgenogram showed a circumscribed osteolytic destruction in the tibia just below the tibial tuberosity (Fig.

11). She was operated upon elsewhere and the cyst was curetted. The tissue removed was sent to one of us. The diagnosis was metastatic papillary carcinoma (Fig. 12) secondary to papillary carcinoma of the bladder. Subsequent roentgen ray studies showed two lesions in the left lower tibia. The patient is now bedridden and failing rapidly.

CASE 6. T. G. T., male, aged 45 years, entered the Presbyterian Hospital on September 21, 1931. On November 6, 1933, a suprapubic cystostomy was performed elsewhere for the removal of a tumor of the bladder. Pathological diagnosis was papillary carcinoma of the bladder. He was readmitted to the same hospital because of multiple abscesses of the left kidney and postoperative obstruction of the left ureter. On January 15, 1934, a left nephrectomy was performed.

Seven months before admission patient developed severe pain in the left hip and thigh, requiring narcotics for relief. He cannot walk without the aid of crutches.

Physical examination revealed a suprapubic and left lumbar scar. Rectal examination was negative. The left lower extremity showed marked muscular atrophy.

We are indebted to Dr. P. J. Randall for the information of the patient's subsequent course.



Fig 4. Case 2. Metastatic papillary carcinoma of the lumbar spine.  $\times 80$ .



Fig 5. Case 3. Typical papillary carcinoma of the bladder.  $\times 80$ .



Fig 6. Case 3. Note pathological fracture of the right ninth rib.

phy and pain on pressure over the left thigh and hip. The blood count and blood Kahn were normal. Blood chemistry was normal. The urine contained 85 pus cells and 300 red blood cells per cubic milli-

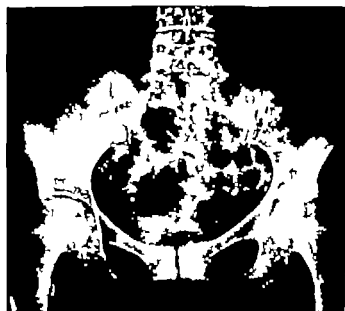


Fig 7. Case 3. Note multiple areas of destruction in the pelvic bones and right upper femur.



Fig. 8. Case 4. Typical papillary carcinoma of the bladder.  $\times 80$ .



Fig. 9. Case 5. Typical papillary carcinoma of the bladder.  $\times 80$ .

meter and on culture showed growth of *Bacillus coli communis*.

Roentgen ray examination revealed marked destruction of the left pubis, the left lower ischium



Fig. 10. Case 4. Note destruction of the right pubic bone.

and the lesser trochanter of the left femur with a fracture through this area. There was general thinness of the left ilium with very tiny areas of destruction. Findings were compatible with metastatic carcinoma (Fig. 13).

Cystoscopic examination (H.L.K.) on September 22, 1934 and September 26, 1934, revealed a normal bladder. The patient was discharged on September 27, 1934, his condition unchanged.

CASE 7. C.B. female aged 61 years, entered the Presbyterian Hospital on April 6, 1928. She had had salpingo-oophorectomy in 1908 and a gall-bladder operation in 1920, performed elsewhere.

One year prior to admission she had had an attack of gross hematuria. This was followed by frequency, nocturia, urgency and suprapubic pain. She has had two subsequent attacks of hematuria, one 6 months ago and one 2 weeks ago.

Physical examination revealed a mild cervical ectropathy, the scars of her previous operations and marked tenderness over the pubic bones. The blood count and Wassermann were negative. The blood nonprotein nitrogen was 40.5 milligrams per cent and the urea nitrogen was 24 milligrams per cent. The urinalysis showed albumin +, 34 pus cells, and 200 red blood cells per cubic millimeter and a few granular casts. Urine cultures were sterile.



Fig. 11 Case 5. Note the circumscribed destruction in the proximal end of the tibia.

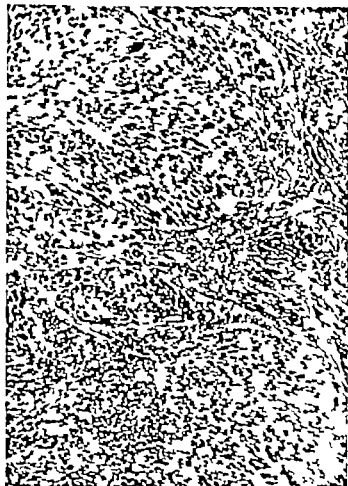


Fig. 12 Case 5. Metastatic papillary carcinoma of the right tibia.  $\times 80$

Cystoscopic examination revealed a tumor of the bladder with areas of superficial necrosis.

Röntgen ray examination revealed a destructive process of the pubis on either side of the symphysis compatible with bone metastasis.

On April 11, 1928, a suprapubic cystostomy was done (H.L.K.). The tumor had extended beyond the bladder. Surgical diathermy was used and pieces of tissue were excised for diagnosis. Microscopic diagnosis: papillary carcinoma of the bladder. Patient was discharged from the hospital on July 3, 1928, and died December 2, 1928.

CASE 8. R. A. F. male, aged 53 years, entered the Presbyterian Hospital on October 19, 1946. Elsewhere in 1937, a suprapubic cystostomy was performed for removal of papilloma of the bladder. Elsewhere in 1938, a transurethral resection of the prostate was performed. In 1943, a left orchiectomy was performed because of abscess. In November, 1944, at the Presbyterian Hospital, a transurethral resection of the prostate was done with resection and fulguration of small papillary tumors on the trigone (H.L.K.). Pathological report was benign hyperplasia of the prostate and papillary carcinoma of the bladder (Fig. 14). In November, 1945, incision and drainage of a perineurethral abscess (H.L.K.) was done. On March 18, 1946, a suprapubic cystostomy was done because of persistent hematuria, frequency, urgency and pain. There were no papillomas in the

bladder but just distal to the vesical orifice papillomatous growths were removed for biopsy which showed papillary carcinoma. On March 28, 1946,



Fig. 13 Case 6. Note destruction of the left pubis, ischium and lesser trochanter with a fracture through the latter structure.



Fig. 14. Case 8. Typical papillary carcinoma of the bladder.  $\times 80$ .

Cytologic microscopic examination showed the bladder to be normal. Examination of the prostatic urethra showed many small papillomas which were resected and fulgurated (H. L. K.). Pathological report was papillary carcinoma.



Fig. 16. Case 8. Note destruction of the fifth lumbar vertebra.

On present admission to hospital patient complained of hematuria and severe pain in the lumbar region radiating into the left leg.

Physical examination revealed a suprapubic fullness. Rectal examination showed a normal prostate. The blood count was normal except for mild anemia. Blood nonprotein nitrogen was 39 milligrams per cent. Urinalysis showed a grossly bloody urine with albumin  $1+$  and pus cells 8 to 10 per cubic millimeter.

Roentgen ray examination October 23, 1948, showed complete destruction of the fifth lumbar vertebra and an area of destruction involving the superior ramus of the left pubic bone (Figs. 15 and 16).

After he left the city, patient suffered rapidly developing paralysis of both lower extremities. He had extreme pain in the lumbar and sacral areas and throughout the distribution of both sciatic nerves. He died in March 1947.

The cases are summarized in Table I.

#### AGE AND SEX

The age of the patients in our series varied from 45 to 73 years with an average age of 59.5 years. There was no apparent relation



Fig. 15. Case 8. Note destruction of the superior ramus of the left pubic bone.

TABLE I.—SUMMARY OF CASES

Case Name	Age Sex	Duration	Urinary symptoms	Metastatic symptoms	Pathological diagnosis	Site of metastases	Type of bone lesion	End results
L.C.M.	33 M	6 yrs	Hematuria Frequency	Pain in left clavicle	Papillary carcinoma	Left clavicle	N-ray	Falling rapidly
L.C.H.	60 M	9 mos.	Frequency Nocturia Drizzling	Pain in sacro-lumbar area	Papillary carcinoma	3d and 4th lumbar vertebrae, lower dorsal vertebrae sacrum	Osteolytic	Died
S.B.	5 F	3 yrs.	Hematuria Frequency	Pain in chest Pain in low back	Papillary carcinoma	Rt. 6th rib and lumbar vertebra rt. femur pubic bones	Osteolytic	Died
M.A.	42 M	3 yrs.	Hematuria Frequency	Pain rt. hip Pain rt. thigh	Papillary carcinoma	Rt. and left pubic bones	Osteolytic	Died
M.A.C.	58 F	37	Hematuria Frequency	Pain rt. lower leg Swelling rt. low leg	Papillary carcinoma	Right tibia, left tibia	Osteolytic	Bedfast and falling rapidly
T.G.T.	45 M	14 yrs.	Hematuria	Pain left hip Pain left thigh	Papillary carcinoma	Left femur left pubis, left ilium left ischium	Osteolytic	Died
G.H.	6 F	37	Hematuria Frequency	Suprapubic pain	Papillary carcinoma	Right and left pubic bones	Osteolytic	Died
R.A.F.	33 M	9 yrs.	Hematuria Frequency	Pain lumbar spine and left leg	Papillary carcinoma	4th lumbar vertebra left pubis	Osteolytic	Died

ship between the age at the onset of the symptoms and longevity. Geschickter stated that females are more prone to develop bone metastases than are males. This has not been our experience in our series there were 5 males and 3 females.

#### TYPE OF BLADDER TUMOR

The primary tumors varied from small benign appearing papillomas to large ulcerating tumor masses. The size of the tumor apparently had little relationship to the formation of skeletal metastases. This is also noted by Nicholson who reported a case in which neither the primary bladder tumor nor the metastatic bone lesion showed evidence of malignancy though both were identical in type and structure. Rathbun and Kretschmer also had noted skeletal metastases secondary to small benign appearing primary tumors. In our cases the primary bladder neoplasm was papillary carcinoma.

In one case (Case 6) the bladder tumor had been treated by segmental resection. There was no evidence of tumor upon two cystoscopic examinations. The patient came to the hospital because of pain due to the skeletal metastases. In Case 8 the bladder was free of papillary tumor but multiple small papillary tumors were found in the prostatic urethra.

#### URINARY SYMPTOMS

Hematuria was present in 7 of our 8 cases and varied from slight intermittent bleeding to continuous bleeding with clot formation. In one case no statements relative to hematuria were noted in history. Frequency and nocturia, dysuria and pain were present in 7 of our 8 cases. Urinary symptoms lasted from 9 months to 9 years. In 4 cases the symptoms were present for less than 1½ years.

#### PAIN DUE TO METASTASES

In 2 instances (Case 2 and Case 6) pain due to the skeletal metastases was the symptom that brought the patient to the hospital. During the early course of the disease the pain was described as rheumatic in type. The pain rapidly became severe and excruciating so that all of the patients required morphine for relief. In Case 5 of our series and in the case reported by Ingraham surgery was performed on the skeletal metastases only to find that they were secondary to a bladder tumor. In the cases reported by Greenfield, Wells and Copeland the symptoms due to the metastatic lesion was the first indication of the patient's illness.

#### ROENTGEN RAY FINDINGS

In 7 of our 8 cases the metastatic lesions were osteolytic in type. In 1 case (Case 1)



Fig. 4. Case 8. Typical papillary carcinoma of the bladder.  $\times 80$ .

cystoscopic examination showed the bladder to be normal. Examination of the prostatic urethra showed many small papillomas which were resected and fulgurated (H.L.K.). Pathological report was papillary carcinoma.



Fig. 5. Case 8. Note destruction of the fifth lumbar vertebra.

On present admission to hospital patient complained of hematuria and severe pain in the lumbar region radiating into the left leg.

Physical examination revealed a suprapubic fistula; rectal examination showed a normal prostate. The blood count was normal except for mild anemia. Blood nonprotein nitrogen was 39 milligrams per cent. Urinalysis showed a grossly bloody urine with albumin 1+ and pus cells 8 to 10 per cubic millimeter.

Röntgen-ray examination October 23, 1936 showed complete destruction of the fifth lumbar vertebra and an area of destruction involving the superior ramus of the left pubic bone (Figs. 15 and 16).

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S.B.	51 F	7 yrs.	Hematuria Frequency	Pain in chest Pain in lower back	Papillary carcinoma	Rt. 5th rib; 3rd lumbar vertebra; rt. femur; pubic bones	Osteolytic	Died
M.T.	58 M	7 yrs.	Hematuria Frequency	Pain rt. hip Pain rt. thigh	Papillary carcinoma	Rt. and left pubic bones	Osteolytic	Died
M.A.C.	70 F	7 yr.	Hematuria Frequency	Pain rt. lower leg Swelling rt. lower leg	Papillary carcinoma	Right tibia, left tibia	Osteolytic	Bedfast and falling rapidly
T.G.T.	46 M	1½ yrs.	Hematuria	Pain left hip Pain left thigh	Papillary carcinoma	Left femur; left pubis; left hum.; left scapula	Osteolytic	Died
G.B.	6 F	7 yr.	Hematuria Frequency	Suprapubic pain	Papillary carcinoma	Right and left pubic bones	Osteolytic	Died
R.A.F.	33 M	9 yrs.	Hematuria Frequency	Pain lumbar spine and left leg	Papillary carcinoma	4th lumbar vertebra; left pubis	Osteolytic	Died

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#### TYPE OF BLADDER TUMOR

The primary tumors varied from small benign appearing papillomas to large ulcerating tumor masses. The size of the tumor apparently had little relationship to the formation of skeletal metastases. This is also noted by Nicholls who reported a case in which neither the primary bladder tumor nor the metastatic bone lesion showed evidence of malignancy though both were identical in type and structure. Rathbun and Kretschmer also had noted skeletal metastases secondary to small benign appearing primary tumors. In our cases the primary bladder neoplasm was papillary carcinoma.

In one case (Case 6) the bladder tumor had been treated by segmental resection. There was no evidence of tumor upon two cystoscopic examinations. The patient came to the hospital because of pain due to the skeletal metastases. In Case 8 the bladder was free of papillary tumor but multiple small papillary tumors were found in the prostatic urethra.

#### URINARY SYMPTOMS

Hematuria was present in 7 of our 8 cases and varied from slight intermittent bleeding to continuous bleeding with clot formation. In one case no statements relative to hematuria were noted in history. Frequency and nocturia, dysuria and pain were present in 7 of our 8 cases. Urinary symptoms lasted from 9 months to 9 years. In 4 cases the symptoms were present for less than 1½ years.

#### PAIN DUE TO METASTASES

In 2 instances (Case 2 and Case 6) pain due to the skeletal metastases was the symptom that brought the patient to the hospital. During the early course of the disease, the pain was described as rheumatic in type. The pain rapidly became severe and excruciating so that all of the patients required morphine for relief. In Case 5 of our series and in the case reported by Ingraham surgery was performed on the skeletal metastases only to find that they were secondary to a bladder tumor. In the cases reported by Greenfield, Wells and Copeland the symptoms due to the metastatic lesion was the first indication of the patient's illness.

#### ROENTGEN RAY FINDINGS

In 7 of our 8 cases the metastatic lesions were osteolytic in type. In 1 case (Case 1)





TABLE I\*—THE CAUSES OF HEMORRHAGE FROM THE UPPER GASTROINTESTINAL TRACT

	Number	Percent of total
Duodenal ulcer	120	62.8
Gastric ulcer	15	7.9
Jejunal ulcer	6	3.1
Gastric neoplasm	5	2.6
Acute gastritis	17	8.9
Esophageal varices	14	7.4
Site undetermined	8	4.2
Miscellaneous	6	3.1
	191	100.0

\*Reinstitutions of the same patient with the same source of bleeding are not included in this tabulation.

sification are (1) the presence of syncope or shock as evidenced by sweating, fainting, cold clammy extremities, hypotension and tachycardia, (2) the lowest hematocrit level recorded and (3) the number of transfusions required to stabilize the circulation. Based upon these criteria, a rough estimate of the amount of blood lost may be made (Table VI).

A moderate hemorrhage is one in which the loss of blood ranges from 500 to 1,000 cubic centimeters. Such patients have melena or ematemesis and occasionally faint at the beginning of the illness but they do not show evidence of syncope or hypotension when reaching the hospital. The hematocrit is above 30; transfusions are rarely indicated. Emergency surgery is never indicated.

In group 2, severe compensated, the loss of blood is serious, amounting to as much as a liter in 24 hours, but the rate of bleeding is sufficiently slow so that with the benefit of occasional transfusions syncope or collapse does not occur after the patient has entered the hospital and the circulation has become stabilized. Such patients may continue to bleed for several days as evidenced by bloody stools. They may develop azotemia and abdominal distention but they always maintain a good circulatory state. About 30 per cent of

TABLE III—MORTALITY ACCORDING TO RAPIDITY OF HEMORRHAGE

Classification	Management	Cases	Deaths
Moderate	Medical	47	0
	Surgical		
Severe compensated	Medical	73	1
	Surgical		
Severe uncompensated	Medical	26	
	Surgical		
Exsanguinating	Medical	8	6
	Surgical	6	
		61	

\*Cor pulmonale

these patients require one or more transfusions. They are not candidates for emergency surgery.

The patients in group 3, severe uncompensated, are serious problems. They lose blood at a rate of a liter or a liter and a half in 24 hours and may continue to do so for several days. They not only have a history of syncope at the time of onset but usually are in shock at the time of admission. However, they respond well to transfusions and once stabilized by an initial transfusion of 1 or 2 liters do not again develop syncope or hypotension. They often continue to bleed steadily as evidenced by tarry stools, hematemesis and a falling hematocrit but provided they are transfused at rates not exceeding 1,500 cubic centimeters daily they always appear to be in a good circulatory state. The indications for transfusions are continued bleeding but without a fall in blood pressure, weakness, faintness, sweating or collapse. Although these patients recover without an emergency operation, they require the closest supervision by both internist and surgeon for at any moment the rate of bleeding may increase sufficiently to place them in the fourth or exsanguinating group of cases.

Under exsanguinating hemorrhage are placed those patients who not only have evidence of marked syncope and shock but who after transfusions of a liter or two fail to maintain a stable circulation despite continued transfusions of not more than 500 cubic centimeters every 8 hours. Characteristically these patients have repeated episodes of sweating, faintness and hypotension despite liberal

TABLE II\*—MORTALITY OF HEMORRHAGE FROM PEPTIC ULCER

	Cases	Deaths	Mortality Per cent
Medical management	154	7	4.5
Surgical management	9	3	33.3
Spital total	163	10	6.1

\*Tables II, III, and IV each hemorrhage is recorded. There were hemorrhages in 141 patients.

TABLE IV—MORTALITY ACCORDING TO AGE

Age in years	Entire series		Group 3 Severe uncompensated		Group 4 Exsanguinating	
	Cases	Deaths	Cases	Deaths	Cases	Deaths
45 or less	63		0		5	
45-50	26		7			
50 or more	7	8			5	6
All cases	76	18	23		10	6

TABLE V—MORTALITY OF COMBINED GROUPS OF SEVERE UNCOMPENSATED AND EXSANGUINATING HEMORRHAGE

Management	1920 through 1945		Jan 1946 through June 1947	
	Cases	Deaths	Cases	Deaths
Medical	12	5		
Surgical	4			
	16	7	5	

transfusions. There may be sharp falls in the hematocrit despite transfusions but signs of syncope or shock are of more value than the exact level of the hematocrit. Repeated hematemesis and uncontrollable pain are often valuable contributory signs but these may be absent and are of less significance than syncope. The one reliable finding is failure to maintain a stable circulation despite transfusions which amount to about 500 cubic centimeters every 8 hours. It is our belief that these are the patients upon whom surgery must be employed.

It is obvious that in classifying patients according to this scheme experience and sound clinical judgment are of the greatest importance. Although a rate of hemorrhage of over 500 cubic centimeters in 8 hours has been set as the dividing line between a severe uncompensated and an exsanguinating hemorrhage the actual amount of loss is of less importance than the patient's reaction to it. *Recurrent syncope is the most valuable single sign.* In appraising these patients the closest co-operation between medical and surgical services is necessary. It is recommended that a bedside team of internist and surgeon follow from the moment of hospitalization every patient in whom emergency surgery may be considered.

The mortality from bleeding peptic ulcer at the Peter Bent Brigham Hospital for the last 7½ years is shown in Table II. During this period there were 163 patient admissions for this complaint, representing 141 individual patients. (Each hemorrhage has been included in computing the mortality. If a patient bleeds at widely separated intervals in different hospital admissions, each episode must be regarded as a separate and distinct risk to life.) Of the 163 hemorrhages, 137 were from duodenal ulcer with 6 deaths, 15 were from gastric ulcer

with 4 deaths, 9 were from jejunal or marginal ulcer and 2 from a combination of gastric and duodenal ulcer. There were 125 males and 38 females and in 74 instances, or roughly 45 per cent, the age of the patient was 50 years or more. Under medical management there were 7 deaths in 154 cases, 4.5 per cent. Among the 9 patients undergoing emergency operation, there were 3 deaths. The hospital mortality rate was 6.1 per cent.

A somewhat different picture is obtained when the cases are classified according to the severity of the hemorrhage (Table III). It can be seen that 8 of the 10 deaths occurred in the exsanguinating group. The 3 deaths in the severe compensated group were not solely the result of hemorrhage. In the medical case, a comparatively small hemorrhage was the final precipitating cause of death in a patient with severe cor pulmonale. The surgical death in this group occurred as a consequence of an operation which by our present standards was ill advised and was carried out without adequate preoperative preparation. Two points are obvious: the fatal hemorrhages are of the rapid or exsanguinating type and in this group the results of surgery are at least as good if not better than medical management. It is our opinion based on a review of the records that the surgical recoveries represent pure salvage, that is, the patients would not have recovered without operation. Moreover among the patients who died under medical management, there are several who in retrospect appear to have been better risks for surgery than some of the patients in whom successful operations were performed.

Table IV analyzes the age factor and deaths in the entire series, in the severe uncompensated and in the exsanguinating groups.

TABLE VI.—A CLASSIFICATION OF CASES ACCORDING TO SEVERITY OF THE HEMORRHAGE

	Syncope or shock in hospital	Hematocrit (or equivalent)	Transfusion	Estimated rate of blood loss
Moderate	None or slight	3 +	No	500 cc. $\pm$ Total
Severe compensated	None or slight	30 less	Frequent (50%)	500-1000 c. per 24 hrs.
Severe uncompensated	Marked	30 or less	Usual (20%) response good	1000-500 c.c. per 24 hrs.
Exsanguinating	Profound, $\pm$ recurrent	30 or less	Massive response uncertain	500 c.c. $\pm$ per 24 hrs.

Although there is a higher proportion of deaths in patients 50 years of age or more it is less pronounced than might be expected in the more serious bleeders in exsanguinating hemorrhage considered alone there were 2 deaths in 5 patients under 45 and 6 deaths in 8 patients 50 or more. The point to bear in mind in connection with older patients is that they are more likely to develop an exsanguinating hemorrhage than younger patients. An apparently mild hemorrhage in an older patient deserves closer watching on this account. But older patients who do not have an exsanguinating hemorrhage have just as good a chance to get well on conservative management as the younger ones. To put it another way, the fact that a patient is over 50 years of age is not an indication for prompt surgery. Indeed quite the contrary, the older the patient the more desirable it is to avoid unnecessary surgery. But old age is a warning that there is greater

danger of an exsanguinating hemorrhage. If it develops surgery is necessary regardless of age. Thus the operative indication is not the age of the patient but the rate of the bleeding.

There is one type of patient for whom immediate surgery should be considered even though the hemorrhage is thought not to be exsanguinating. Every clinic has patients being followed medically for peptic ulcer who have bled in the past and in whom one more hemorrhage will be sufficient cause to recommend interval surgery. If such a patient should present himself in good condition within a few hours of the onset of a hemorrhage a strong point can be made out for transfusion and immediate operation not only to check the bleeding but also to provide the corrective subtotal gastric resection. This combines as it were the otherwise separate risks of the hemorrhage and the interval operation. If such a patient is seen late in the course of a

TABLE VII.—OPERATIONS FOR ACUTE HEMORRHAGE FROM PEPTIC ULCER

Peter Bent Brigham Hospital—January 1940 to July 1947

Year	Age Sex	Group	Site	Duration pre-operative	Blood pre-operative	Blood 1 operation	Procedure	Result and comment
July 43	62 M	Exsanguinated	D	24 hrs	1,000	1,000	Direct ligation	Recovery
July 43	41 M	Severe compensated	D	8 days	300	300	Gastric resection	Death on table. Inadequate pre-operative preparation
Oct. 44	38 M	Severe compensated	G	96 hrs	800	1,000	Gastric resection	Recovery
Nov. 44	65 M	Exsanguinated	G	3 hrs	3,500 + 1,000 Pt		Gastric resection	Death first postoperative day
Sept. 45	44 M	Exsanguinated	D	34 hrs	1,500	2,500	Gastric resection	Death on table. Sympathectomy for hypertension 6 months ago
May 46	41 M	Exsanguinated	G	18 hrs	300	1,000	Gastric resection	Recovery. Ulcer perforated 5 days previously
Aug. 46	41 M	Exsanguinated	G	24 hrs	1,000	300	Gastric resection	Recovery
Nov. 46	41 M	Severe uncompensated	D	42 hrs	500 750 Pt	300	Gastric resection	Recovery
Dec. 46	41 M	Exsanguinated	G	hrs	1,000	2,000	Gastric resection	Recovery



# FIVE YEAR END-RESULTS OF IRRADIATION THERAPY OF CANCER OF THE CERVIX UTERI AT THE MEMORIAL HOSPITAL

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A REPORT of the five year end results in 1072 cases of primary carcinoma of the cervix in patients treated at Memorial Hospital during the period of 1934-1941 inclusive follows. These data were compiled for publication by the League of Nations Health Organization in its first report since 1941. In that year its last report presented a statement of results obtained in 1933 and previous years with radiotherapy in cancer of the uterine cervix at 17 different institutions in the United States, the British Isles, and the continent of Europe. Further collection of data was interrupted by the war but this is now being resumed under the editing direction of Professor J. Heymann of the Radiumhemmet in Stockholm.

The data in the tables in this paper are presented in the manner required by the League of Nations Health Organization. Only patients with cancer of the cervix uteri (including primary carcinoma of the stump) are included and these are instances in which the treatment carried out was entirely radiological. Only primary cases are included; patients having recurrent cancer following radiological treatment elsewhere are omitted. Precancerous conditions are excluded as are also sarcomas and malignant mixed tumors. All patients examined whether treated or not are included. Notation is made of those patients lacking microscopic verification of disease. To be classified as 'cured' the patient must be alive after 5 years or more and free from evidence of disease after treatment. Other requisites of the organization are made but the above are the essential ones.

It was felt that these figures comprising a large series of patients (1072) should be made

available to American readers simultaneously with their presentation to the League of Nations Health Organization for publication. The data also suggest further discussion of the treatment of cervix carcinoma.

## METHODS OF TREATMENT

Treatment during these years involved different techniques of external roentgen therapy together with a fairly constant method of radium application to the uterus. There was the massive dose technique of pelvic roentgen therapy in which the patient received 750 roentgens at a single treatment to each of four pelvic fields, 50 centimeter target skin distance, 200 kilovolts 0.5 millimeter copper filtration. Also there was the "divided dose" technique in which the patient received 12 treatments of 200 roentgens each to each of six fields, 70 centimeter target skin distance, 200 kilovolts 0.5 millimeter copper filtration. The pyramidal dose technique was a variation of the latter in which the number of roentgens per treatment was gradually increased. The superiority of the "divided dose technique" became evident after comparative study of the two methods (1).

External roentgen therapy was the supplement to radium application to the uterus in the form of a 'cervix tandem' to deliver 3000 milligram hours of radium within the cervix and also by means of a vaginal "bomb" applicator to deliver 1,500 milligram hours against the cervix.

## RESULTS

As already mentioned the tables are presented in the form in which they are submitted to the League of Nations Health Organization. Table I presents the total number of patients with primary cancer examined in these

TABLE I.—PATIENTS EXAMINED AT THE CLINIC

Year	Total number of patients examined with view to treatment	3		4	5	6	7	8	9	10	11
		Patients examined clinic—but not treated		Not accepted for radiological treatment				Accepted for radiological treatment but not treated. Reasons			
		No.	%	Operation advised	Lack of resources or therapeutic facilities	Unsuitability—general condition, extent of disease, etc.	Other specified reasons	Refusal by patient	Prevented by death or disease	Sought treatment elsewhere	Unknown
1914	49										
1915	40										
1916	43	7	9			3					
1917	47	8	5			0					
1918	17	4	4								
1919	5										
1920	17		8								
1921	5	6	8								
Total	107	3	2			14	6	3	1		1

years with further division into those treated and those not treated. Of the 1,072 patients examined 96.7 per cent or 1,037 were treated. Reasons for nontreatment are stated.

Table II presents the total number of patients treated in each year with breakdown into the four stages of the League of Nations anatomical classification. It is interesting to note that in the early years of this series the greater proportion of patients were in the more advanced stages of disease and that this situation tended to reverse itself in the later

years. This presumably represents the increasing cancer consciousness of the lay public and referring physician. This breakdown into stages undoubtedly incorporates some degree of error since it was necessary in compiling these statistics to change the old method of classification used at Memorial Hospital to that system suggested by the League of Nations. This possible error also affects the results of cures according to the different stages and will be mentioned again when the last four tables are discussed.

TABLE II.—PATIENTS RADIOLOGICALLY TREATED

Year	Total number of patients treated stages I-IV	Stage I		Stage II		Stage III		Stage IV		No. of cases without macroscopic verification	
		No. of cases	%	No. of cases	%	No. of cases	%	No. of cases	%	No.	%
1914	146		8	34	3.3	99	67.8				
1915	36	17	5	30	16	76	55	6	3		1.4
1916	25	3	8.5	23	26	69	5	6	4		
1917	39	16	8.8	27	16.5	63	46.8		7.9	4	8
1918		3	5	54	46	43	38.8	3	7	3	7
1919	17	25	19	3	3.8	36	29.8	5			6
1920	16	41	3.5	40	30	13		8	6.3		
1921		30		48	44.4	36	30.3	3			
Total	37	200	19.3	99	7.7	414	4.7	44	4.1	3	

TABLE III.—RESULTS OF TREATMENT

Year	No. of patients treated	3					4					5					6					7				
		Alive without evidence of the disease after a period of observation of (years)					Alive but not cured after a period of observation of (years)					Died of cancer during period of observation of (years)					Lost sight of during period of observation of (years)					Died of intercurrent disease during a period of observation of (years)				
		5	6	7	8	9	5	6	7	8	9	5	6	7	8	9	5	6	7	8	9	5	6	7	8	9
1934	146	43	30	37	33	30	8					8	83	84	86	87	87	14	5	6	17	8	7	8	8	9
1935	138	30	5	5	3	0	7					85	85	90	9	91	95	5	14	5	6	7	8	8	8	9
1936	35	37	33	34	3	30	8	4				85	86	90	0	92	7	7	8						3	4
1937	50	43	40	30	17	35						68	88	88	86	89	8	9								3
1938	13	3	30	26	26							66	67	68	6								3	4	6	6
1939		4	40	25								7	71	7			7	7	8							
1940	26	30	33									7	73				4						4			
1941	9	53										77					5					3				
Total	37	297						3				5030					7					26				

Table III presents the number of patients alive without evidence of disease after a period of observation of at least 5 years and also those alive after this time but not cured. Columns 6 and 7 in this table contain those patients lost for follow up examination and those who died from some other cause both latter types of patient were considered *not* cured in computing 5 year end results.

Table IV presents the overall end results for at least 5 years without breakdown into stages of extent of cancer. It is the most important table. The absolute cure rate (column 5) is computed on cures per total number of

patients examined regardless of whether or not treatment was given. The relative cure rate (column 6) is based on cures per total number of patients actually treated. For the 1037 patients in all 4 stages actually treated the 5 year overall relative cure rate was 28.6 per cent.

In examining the relative cure rate by years one is immediately struck by the maintenance of an almost constant level of overall cure rates for these 8 years. There was no tendency for them to rise. This plateau tendency prevailed in spite of some increase of patients with the earlier stages of the disease.

TABLE IV.—STAGES I—IV—EVALUATION OF RESULTS

1	2	3	4						5						6					
Year	Total no. of patients examined with a view to treatment	Number of patients treated	Alive without evidence of the disease after period of observation of (years)						Absolute cure rate at end of (years)						Relative cure rate at end of (years)					
			5	6	7	8	9	5	6	7	8	9	1	5	6	7	8	9		
1934	146	146	43	30	37	33	30	28	28	26	24.9	23	30	27	20.3	26.7	24	20.3	20.8	
1935	138	138	30	25	26	23	0	17	4	20.0	18.6	6.4	13.6	7	20.3	18.9	6.7	13.6	2.3	
1936	143	135	37	33	34	3	30	28	26	24.6	23.9	2.5		17	27.4	34.0	3	27.3	20.7	
1937	147	130	43	40	30	37	35		22.6	27	26.5	5.3	23.8		30.2	28.8	26	26.6	5.2	
1938	17	13	3	30	26	26			27.4	5.7	2	3			26.3	26.6	3	23.1		
1939	15		4	40	25				3	22.0	20.8				33.8	23	21.4			
1940	27	26	30	33					30.8	26					3	26				
1941	125	0	23						27.0						28.0					
Total	52	17	297						7.7	27					28.6	28				



TABLE V—STAGE I—EVALUATION OF RESULTS

Year	Number of patients treated in stage I	3							4						
		Alive without evidence of the disease after period of observation of (years)							Relative cure rate after period of observation of (years)						
		5	6	7	8	9	10		5	6	7	8	9	10	
1934	3	7	6	6	6	6	4		33.9	46	46	46	46	46	30.1
1935	17	8	8	8	7	7	7		47	47.3	47		41	41	
1936	5	3	13	3	3	3			5.0	33	5	33	33	46	
1937	10	5	3	3	3	3			6.9	37.7	37.7	37.7		37.7	
1938	3	8	7	6	6				6.3	33.3	46	46			
1939	15	16		14					43.7	43.9	49				
1940	41	3	80						59	49					
1941	30	3							30						
Total	100	100							31.0%						

Tables V VI VII and VIII present the relative cure rate by extent of disease according to the League of Nations anatomical classification stages I II III and IV respectively. The decrease in cure rate with increase in extent of disease is obvious. No stage IV patient was ever cured. The data show a rather striking uniformity of results obtained between the years 1934 and 1941 i.e. 52 to 62 per cent for stage I (with the exception of 2 years when the results were 47.1 and 45.7 per cent). For the 200 stage I cases in which patients were treated over the 8 year period the relative cure rate was 53.0 per cent (Table V). The apparent peaks in 1937 and 1938 lose significance when it is noted that only 39 stage I

patients were treated in these 2 years. For stage II the results were 24 per cent to 30 per cent except for 3 years when the results were 41.2 per cent, 40.4 per cent and 42.2 per cent, respectively. The significance of these years in which better results were obtained is lessened by the fact that they were not obtained at the end of the period studied and thus do not indicate consistent improvement in method. Instead these good years occur irregularly throughout the 8 year period. In the last 2 years the stage II results were 24.5 per cent and 28.8 per cent respectively whereas in 1935 and 1936 they were 30.8 per cent and 34.3 per cent, respectively. For stage III the relative cure rate varied from 6.7 per cent in

TABLE VI—STAGE II—EVALUATION OF RESULTS

Year	Number of patients treated in stage II	Alive without evidence of the disease after period of observation of (years)							Relative cure rate after period of observation of (years)						
		Alive without evidence of the disease after period of observation of (years)							Relative cure rate after period of observation of (years)						
		5	6	7	8	9	10		5	6	7	8	9	10	
1934					13	10	30		41		41	33.3	39	39	
1935	30				20	8	7		30.8	38	3.6	3.6	30.5	36	
1936	5					30			34.3	34.3	34.3		28.6	28.6	
1937	17		8	8	8	8			14	5	6	6	6	6	
1938	5		30	8	8				40	36.5	34.6	34.6			
1939		9		8							49				
1940	40		10						24.5	30					
1941	48	3							28.8						
Total	10								31.0%						

TABLE VII—STAGE III—EVALUATION OF RESULTS

Year	Number of patients treated in stage III	3						4					
		Alive without evidence of the disease after period of observation of (years)						Relative cure rate after period of observation of (years)					
		5	6	7	8	9		5	6	7	8	9	10
1934	90	3	0	7	5	4	4		0	17	5	14	14.1
1935	76		0	8	6	4	3	3	0	5	7.0	5.3	3.0
1936	60			9	8	7	6	7	14.5	3.1	.6	0.	8.7
1937	65	7	7	6	14			16	16	24.6	1.5	18.5	
1938	45	3	3					6.7	6.7	4.7	4.7		
1939	36	6	6	6				6.7	6.7	6.7			
1940	8	4	3					4.4	7				
1941	16	5						4					
Total	454	70						7.4 <sup>67</sup>					

1938 to 22.2 per cent in 1934 with an 8 year average for 454 stage III patients treated of 17.4 per cent.

We have not attempted to draw much significance from the fact that some years gave relatively high or low cure rates for individual stages for two other reasons first, the number of patients in each stage per year is not large enough to be statistically significant second, in compiling these statistics it was necessary to reclassify into League of Nations stages I-IV the old Memorial Hospital classification of early, borderline, and advanced. Since the two types of classifications varied somewhat when compared the reclassification had to be made from descriptions on the pa-

tients charts of the extent of disease. In most cases these descriptions were adequate to permit accurate reclassification. Obviously however any such method of classification not made at the time of initial examination of the patient would tend to introduce some error into the breakdown of cases and statistics for individual stages. These objections cannot be raised against the figures in Table IV.

Most obvious in the study of these statistics is the 'plateau tendency' of the overall cure rate in Table IV. No more patients were being saved in 1941 than in 1934. Although differential study within this series had established relative superiority of 'divided dose technique' of external roentgen therapy over

TABLE VIII—STAGE IV—EVALUATION OF RESULTS

Year	Number of patients treated in stage IV	3					4				
		Alive without evidence of the disease after period of observation of (years)					Relative cure rate after period of observation of (years)				
		5	6	7	8	9	5	6	7	8	9
1934										0	
1935	6									0	
1936	6						0.0				
1937											
1938	3			0							
1939	5	0									
1940	8										
1941	5										
Total	41				2		0				

massive dose technique, it became apparent that radiotherapy in cancer of the cervix had reached a maximum level of efficiency beyond which it was not advancing. In 1943 in search of improved methods of irradiation technique, a comparative study of the use of vaginal cone roentgen therapy and parametrial radon needles was begun. A preliminary report of this study was made by Taylor and Twombly in 1946. In 1945 radical hysterectomy was instituted for the treatment of selected early cases of cancer of the cervix uteri by Taylor

#### DISCUSSION

It has been the purpose of this paper to present the 5 year end results in 1,072 patients with cancer of the cervix seen at Memorial Hospital in the period 1934-1941 inclusive. The 5 year overall cure rate for the 1,037 patients treated by irradiation was 28.6 per cent.

The conclusion to be drawn from these studies is that there appears to be little consistent amelioration in results of the management of carcinoma of the cervix during the years studied. A perusal of reports concerning the results of irradiation therapy for carcinoma of the cervix carried out in widely scattered

centers leads to a similar impression. It therefore follows that the question must be raised as to whether or not the exclusively radiotherapeutic management of cervix carcinoma should continue to be pursued without some form of combination with surgical attack. The continued repetition in standard texts even of recent date that radical hysterectomy for cervix carcinoma is accompanied by a high mortality rate has been a strong influence in discouraging surgical attempts in this field. However, Meigs has shown that modern surgical effort in an appreciable series of selected patients should not entail significant mortality and therefore the argument of mortality does not now have the force which it did two decades or more in the past.

The problem is not one of irradiation therapy versus surgery; it is what can be done to increase progressively the incidence of cure in carcinoma of the cervix uteri?

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# EDITORIALS

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## SURGERY Gynecology and Obstetrics

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## ANGIOCARDIOGRAPHY

**A**NGIOCARDIOGRAPHY is the roentgenographic examination of the heart and great vessels following the intra venous injection of radio-opaque material. The first extensive use of the procedure was reported in infants by Castellanos, Garcia and Pereira, and in adults by Robb and Steinberg. It has been applied by the present writer and his associates in nearly 1500 cases comprising well over 2000 injections without any serious untoward results. Reactions to the procedure ordinarily are mild and have completely subsided in a few minutes. Rarely a transient, shock like state occurs. To minimize the frequency of this occurrence patients are carefully screened to exclude those with definite allergic tendencies and those suffering from any condition in which a rapid drop in blood pressure might not be tolerated. Severe liver or kidney damage are also contraindications. Further more individual sensitivity to the radio-opaque material is tested by the preliminary injection of a small amount.

Successful angiocardiology depends upon a well integrated team of workers. The radio-opaque material 40 to 50 cubic centimeters of 70 per cent diodrast in adults and amounts in proportion to body weight in children must be injected as rapidly as possible. For the roentgen procedure the author currently uses an arrangement which permits exposures to be made as fast as two per second. In other cases an exposure is made at every heart beat in preset phases of the cardiac cycle. He also employs motion picture photography of the fluoroscopic screen. On the other hand Temple, Steinberg and Dotter make successive photographs of the fluoroscopic screen on 70 millimeter film.

The major value of angiocardiology to the clinician resides in the delineation of the anatomy of the heart and great vessels. When the injection is successful there are visualized successively the superior vena cava, the right auricle, the right ventricle, pulmonary artery and its branches, the pulmonary veins, left auricle, left ventricle, the aorta and the branches of this vessel arising from the arch. In many children and in the occasional adult one or more of the coronary arteries have been seen. Mediastinal tumor therefore is usually easily differentiated from aneurysm since the latter fills with the opaque material along with its vessel of origin. An aneurysm which is largely filled with clot will not become opaque but the diagnosis of an aneurysm may be suggested by evidence of disease in other segments of the aorta.

The alteration in the pulmonary vascular pattern in various thoracic diseases was described by Robb and Steinberg. They refer to pressure on and displacement of the hilar

vessels by enlarged glands. They observed these changes both in primary and secondary tumors of the mediastinum as well as in tuberculosis. In pulmonary tuberculosis they describe changes in the pulmonary circulation which fall into three main types. These are diminished vascularity resulting from the narrowing and obliteration of blood vessels in exudative tuberculosis and from fibrosis in the productive type; gross displacement of the intrathoracic cardiovascular structures by extensive pulmonary fibrosis and displacement and stenosis of the pulmonary artery by tuberculous adenitis. In tuberculous fibrosis emphysema, chronic pulmonary suppuration and pulmonary cyst or neoplasm there is a decrease in the vascularity of the involved regions while in other portions there appears to be an increase in size and number of blood vessels.

Our own interest has been chiefly in lung cancer. Here we have found that an infiltrative tumor distorts, compresses and occludes the vessels in the area of involvement. When the tumor is located near to a large branch of the pulmonary artery this branch is likely to be partially or completely occluded. In the presence of a circumscribed tumor which is not invasive even though malignant the vessels are displaced and compressed but are not ordinarily occluded. Angiocardiography may be of diagnostic value therefore when bronchial neoplasm is suspected but is not proven even by bronchoscopy. Enlarged mediastinal nodes may be indicated by pressure on the large vessels but neoplastic infiltration cannot be assumed unless there is distinct irregularity in outline. The point of obstruction in mediastinitis and in certain instances of restrictive pericarditis also can be visualized as well as the collateral circulation.

Recent advances in the surgery of congenital abnormalities in the cardiovascular system

have pointed up the usefulness of angiocardiography. Thus the site and extent of coarctation of the aorta can be shown as well as the presence of an associated aneurysm. We have been impressed with the frequency of what we have called atypical coarctation in which the aorta does not show the usual uniform and progressive diminution in size but is characterized by constricted segments alternating with dilated areas. Presumably these are variations of coarctation but the constriction is not of sufficient degree to disturb the dynamics of the circulation. On the other hand, an associated constriction of a major vessel such as the subclavian artery which is frequently demonstrated on the angiocardiogram, may be clinically manifest.

An alteration in the outline of the proximal descending aorta is found regularly in the presence of ductus arteriosus but this does not necessarily indicate patency. In most cases, according to the observation of A. S. W. Touroff made at operation, this probably represents a local fusiform dilatation of the aorta but in some cases it might be a traction aneurysm or the outline of the infundibulum of the ductus. When a large shunt is present, the pulmonary artery is revascularized. In the tetralogy of Fallot the anatomical features of pulmonic stenosis and right ventricular hypertrophy are shown and in addition, the shunting of blood from the right ventricle into the overriding aorta and into the left ventricle. The size of the pulmonary artery can ordinarily be made out but failure to visualize this vessel does not necessarily indicate pulmonary atresia. The position of the aortic arch and its branches also is useful preoperative information. In the Eisenmenger complex, there is a similar appearance but without pulmonic stenosis and with a dilated pulmonary artery. In this condition there is less of a venous arterial shunt so that although the aorta is

visualized simultaneously with the pulmonary artery, it is not as dense as in the tetralogy

We need not here detail the findings in other congenital lesions. Suffice it to say that the combination of an accurate history, careful physical examination, electrocardiography, and when necessary the application of such special techniques as cardiac catheterization, angiocardiology, and microplethysmography permit a complete anatomic and physiologic diagnosis in most cases. The same combination of procedures has added immeasurably to our understanding of the altered cardiac dynamics found in normal subjects during exercise and in those with right ventricular strain due to mitral disease and pulmonary insufficiency. We may confidently anticipate that the continued integrated use of these methods will inevitably increase our understanding of and diagnostic acumen in cardiovascular disease.

MARCY L. SUSSMAN

### IS THERE AN ADEQUATE THERAPY FOR REGIONAL ENTERITIS?

**A**LTHOUGH surgery at present offers the best opportunity for palliation and control of regional enteritis, an extensive experience with this disease at the Beth Israel Hospital in Boston indicates that the end results of any and all treatment leave much to be desired. Many of the questions raised when the disease first became generally familiar are still unanswered. For instance, we do not know whether the disease is an infection, a nutritional deficiency disease, or a psychosomatic disorder. As surgeons, we stand in regard to this disease in a worse position than we do with ulcerative colitis, because colectomy can provide a final and definitive cure for ulcerative colitis, while excision of the involved bowel in regional enteritis frequently does not.

It has recently been stated that if all inflamed loops of small bowel are not removed, recurrence or inadequate control of the disease is the result. But the fact is that recurrence may result even if all the inflamed loops are removed.

The frequent occurrence of unsatisfactory end results following surgery naturally brings up the matter of nonsurgical treatment. What is the medical treatment of regional enteritis and what does it have to offer? The medical treatment of regional enteritis aims at improving and maintaining nutrition, correcting anemia, and relieving pain and diarrhea. A high vitamin, high protein, high carbohydrate, low residue diet with liver, iron, and calcium supplements and the judicious use of sedatives and antispasmodics and of chemotherapy are the chief therapeutic measures available. Finally, since many patients with this disease have psychosomatic difficulties, psychotherapy is also thought by some to be helpful.

How effective is medical management? The earliest form of the disease is occasionally encountered as an unexpected finding in patients operated on for right lower quadrant pain. Some of these patients have recovered without further therapy of any kind. Some have not. Some of those who have had medical care have become well sooner or later and have avoided surgery. It is impossible to tell whether arrest of the disease was achieved because of the medical therapy given, but all are agreed that spontaneous arrest does occur. This being so, no patient should be subjected to surgery simply because he is known to have the disease. The symptoms must be disabling and must have failed to yield to the best medical treatment, because surgery is certainly not a completely reliable therapy whatever the stage of the disease with which one is dealing. It is pertinent to inquire whether the best medical treatment as here described can still be im-

proved? Possibly The intestinal antibiotics have not been sufficiently exploited. Massive local and parenteral chemotherapy is some times accompanied by at least temporary improvement, so striking as to be hardly coincidental.

The need for surgery in a substantial percentage of patients will be unavoidable because of the intensity of suffering or the speed of deterioration or both. Whether we are adherents of one or another form of therapy abscess, fistula organic stricture or hemorrhage will compel surgery. But what has surgery to offer patients without these complications? The picture is not too bright despite many optimistic reports by surgeons. It is stated in a paper published in 1945 that resection in chronic terminal ileitis was satisfactory in 35 of 44 cases followed for over one year. It is important to point out that a satisfactory result for one year is no more a test of cure of regional ileitis than it is of cancer of the breast. We have recently had a patient who was well for fifteen years after a resection for regional enteritis and who then developed extensive recurrence which required a second resection. We could cite many similar cases of recurrence years after what appeared to be an adequate resection. Everyone knows however that removal of all the visibly involved bowel is not equivalent to complete eradication of all diseased tissue because the involved lymph gland area is far more extensive than the involved bowel. One might ask whether it is desirable or possible to remove all lymph nodes? That it is desirable is questionable that it is possible is almost certainly not the case because even the nodes which are not palpable may also be involved. Recurrence is not uncommon in the glands as well as in the bowel considerably proximal or distal to an anastomosis performed in an area free of disease. So it is not surprising that some authorities now conclude that resec-

tion is best avoided and that a defunctioning ileocolostomy is preferable. But is great confidence justified in a defunctioning ileocolostomy? A review of what has happened to the patients who have had this procedure fails to support the optimistic view of its proponents. We have seen patients in whom ileocolostomy and exclusion failed completely to protect against further spread of the disease, which in some cases ultimately involved most of the small intestine. Nor did subsequent extensive intestinal resection with a new anastomosis between normal loops of bowel succeed in restoring some of these patients to good health. Regional enteritis may not only progress proximally to involve large areas of the small intestine but may also advance distalward and produce a lesion which may be indistinguishable from ulcerative colitis.

From a review of our experience we have concluded (1) that no patient should be given definite assurance that he will be cured by surgery (2) in about half the patients requiring surgery a defunctioning ileocolostomy or resection will provide sufficient relief without the need for a subsequent operation. In the other half reoperation may sooner or later be required, but if a second operation is required, the likelihood of benefit from it is less than from the first, whatever type of operation is performed. The choice of procedure is by no means established. A working rule for the present might be (1) a defunctioning ileocolostomy for the uncomplicated and (2) primary or two stage resection for the complicated case.

We are dealing with an inflammation in which no specific bacterial flora can be incriminated and yet the disease has all the earmarks of an infection. Finally frequent failures by both surgical and medical treatment emphasize the need for a more intensive study of the pathogenesis of this disease.

ARNOLD STARR

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## THE BOOK SHELF

### "AND SO TO BED

ESTHER H VINCENT Evanston Illinois

**I**N the days when Oliver Cromwell was lording it over England in true Puritanical style, there came down to London from his native Huntingdonshire, a young tailor by the name of John Pepys. As far back as the reign of Edward I there had been Pepyses in the fen-country. Theirs was an orderly and administrative clan slowly rising from the yeoman farmer class to that of gentry and, since 1563 even sporting a coat of arms. In the early years, when monasteries and other church communities had blossomed like roses among the green hedges of that rich level country the Pepys men had flourished as business agents for the church dignitaries.

John, the tailor was a younger son and so quite naturally went into trade. In London he married fifteen year old Margaret Knight, the pretty but stately sister of a White chapel butcher and wash maid to my Lady Vere. This was regarded as a mésalliance even by the children who were wont to refer to their maternal ancestry with a certain disparagement. However the young couple settled down to family life in a house in Salisbury Court Fleet St. hard by St. Bride's and almost opposite the present offices of *Punch*.

In spite of a marked lack of cordiality on the part of the exclusive Merchant Tailors Guild, pro-

vincial Mr Pepys prospered and did so well that he was able to educate his children properly. Young Sam born in 1633 was the fifth child and the second son of a large family all of whom he survived. Educated in Huntingdon and at St. Paul's, London, he went up to Cambridge at barely eighteen. He entered Trinity Hall in 1650 but migrated

shortly via a scholarship to Magdalene College where he took his degree in 1653. Little is known of his undergraduate career but it is recorded that he wrote a romance, *Love is a Cheat* which he later destroyed, and that, along with another lad, he received a public scolding for having been scandalously overdone in drink. It is certain however that he made good use of his study hours for in later life, he found himself possessed of a fuller store of learning than that of most of his associates.

Samuel's great aunt Paulina had married Sir Sydney Montague a noble roundhead and became the mother of Sir Edward Montague friend of Cromwell and colonel in his army. Later Sir Edward served as Vice Admiral of

the Fleet under Blake, became a full Admiral, and in spite of his puritanical past, was created first Earl of Sandwich by Charles II. Until his death in action at sea Sir Edward was Samuel Pepys's great friend and patron. It was through the efforts of this titled relative that Pepys secured public employment. When he first took office he



Samuel Pepys

1633-1703

After the portrait by John Hay

From the Archibald Church Library Northwestern University Medical School.



was so ignorant of business that he did not even know the multiplication table, but he soon mastered all mechanical details by working overtime. The year 1660 saw him appointed Clerk of Acts in the Navy Office, and 1673 witnessed his elevation to Secretary of Naval Affairs. True to the tradition of his ancestors, he was an excellent public servant, shrewd, diligent and laborious. The only check to the flowing tide of his public life was during the fanatical excitement of the Popish Plot, when he was sent to the Tower on a trumped up charge of treason.

His scholarship and general culture were such that he achieved fellowship in the Royal Society and was its president for two years. At various times he was Governor of Christ's Hospital, Master of Trinity House, and Master of the Clothworkers' Company. He represented Harwich in Parliament. His chief literary effort, other than the famous *Diary* was the *Memoirs of the Royal Navy* published in 1690. An inveterate collector he surrounded himself with books, manuscripts, prints, ballads, and illustrious friends.

This great and good servant of the King kept a shorthand diary for almost ten years of his gayly respectable life, an intimate, gossipy personal chronicle that has delighted a gasping world. Not only does it reveal the life of a bright, young man-about town, an important public official during the Restoration, but it discloses with psycho-analytic frankness the secret activities of personality that most men hesitate to acknowledge even to themselves. There is nothing like it in any other language! His weakness for drink, fine clothes, playhouses and ladies, his marital relations, his back-stairs gossiping and wire-pulling, his good resolutions and his back-slidings, all are set down with candid-camera clarity. To read the *Diary* gives one a series of little, pleasurable shocks, as well as an amusing picture of the racy London of his day.

Robert Louis Stevenson regards Pepys as an eternal child, who preserved to middle life the gusty emotional immaturity of adolescence. Sweetly sentimental about himself, he sought with boyish anticipation all the joyous, worldly show. He must always be doing something agreeable and always be doing it with someone. He 'knew not how to eat alone. A sterling humanist, he came very near to being an artist. Gleeefully following the footsteps of the contemporary Mrs. Grundy his morals were decent enough for his times. Respectability meant much to him, and he was wont to repent only when found out. He could not be bribed, but was not so squeamish as to receive a present after. All is set down with happy ear

nestness and with completely unconscious humor.

In December 1655, at St. Margaret's, Westminster Samuel married fourteen year old Elizabeth Marchant, daughter of a Huguenot refugee and an Irish woman. Elizabeth was pretty and very good company when she is well. She had a bright, clever little face, with a long upper lip, a full bosom, and a stylish forehead-curl. She chattered away in both English and French, and set out to learn arithmetic, music and globes from Sam. She was a good wife with a spirit of her own, although she had much to put up with. Sam was infernally jealous, yet saw no reason for loyalty on his own part. The Deb Willet episode of November 1668 turned Elizabeth into an outraged Juno, and the *Diary's* wrong dating and expressions of 'phrenzy' show Sam's mental reactions.

Elizabeth's memorial bust, erected by her husband in St. Olave's, Hart St., shows that she probably had adenoids, and it is known that she suffered from dysmenorrhea for many years. We know also that she had toothache and canker, the latter probably due to wax, since syringing cured it. In 1663 she had a perineal abscess which ended in a fistula.

On November 16 1663, "Mr Hollyard came, and he and I about our great work to look upon my wife's malady which he did, and it seems her great conflux of humours heretofore that did us to swell there did in breaking leave a hollow which has since gone in further and further till it is now three inches deep, but as God will have it did not run into the bodyward, but keeping to the outside of the skin and so he will be forced to cut open all along, and which my heart will not serve me to see done, and yet she will not have no one else to see it done, no not even her mayde; and so I must do it poor wretch for her.

Next morn Mr Hollyard on second thoughts "believes a fomentation will do as well, and what her mayde will be able to do as well without knowing what it is for but only that it is for the pain. Mr Hollyard received three pounds "for his work upon my wife, but whether it is cured or not I cannot say but he says it will never come to anything, but it may ooze now and again.

An ischio-rectal abscess is the probable diagnosis, although considering her husband's rampant habits, she may have acquired an acute inflammation of Bartholin's glands.

Later she had abscesses in the cheek which "by God's mercy burst into the mouth, thus not spoiling her face. This plus the frequent toothache may have been due to pyorrhea. Elizabeth never became pregnant, although she had a couple of false alarms.

After fifteen somewhat hectic married years, she died in 1669 when only 29. The two Pepyses had just returned from a visit to France and the Low Countries when Elizabeth fell desperately ill of a fever. Speculation as to the cause of death runs to typhoid or a septic pneumonia arising from pyorrhea.

The *Diary* abounds in medical topics—scrofula, smallpox, and plague in addition to the author's own afflictions of indigestion, colds, eye strain and urinary calculi. His life long anxiety regarding the stone began with a country hike when the 20 year old Pepys and his Cambridge friends went out to visit a famous well. The hot and thirsty Samuel drank copiously of the cold water and upon returning to his room suffered an attack of renal colic. After several painful days, the stone dropped into the bladder. Contrary to the usual sequence this stone was not voided and may have formed the nucleus of the calculus which brought him to the operating table 5 years later. His mother once voided a large stone, which she threw into the fire and later a brother developed symptoms of the same nature.

The outstanding event of Pepys's life was his operation for removal of the stone. This occurred on March 2, 1678 and ever afterward Pepys observed the day with pomp and circumstance. Most people of the seventeenth century endured surgery with little aid other than stout hearts and sluggish nervous systems, and so it was with Pepys poor wretch.

Cutting for the stone originated in India and reached Greece early enough to be mentioned in the Hippocratic Oath. The operation was first performed only on children. The child was held on the lap of one muscular assistant, while two others held its arms and legs. The surgeon put one or two fingers in the little anus and tried to push the stone down on to the perineum while another assistant made use of hypogastric pressure. The surgeon then made a transverse incision above the anus, praying to the gods that he would hit the neck of the bladder. He then attempted to push out the stone with his fingers still in the anus. If this did not work he grabbed the stone with forceps and pulled it through the perineum.

Later improvements included employment of still another assistant to sit on the patient's chest, and further resort was made to tying the patient with ropes. Pepys was probably kept quiet with yards of hemp. One can imagine the solemn arrival of the surgeon at the house with his dread army of assistants and tools. Two operations were current, that with "little apparatus" and that with grand apparatus.

Preparations consisted of placing the patient on the table with head roused and buttocks projecting beyond the end. The legs were flexed at the knees and tied with ropes in a sort of clove-hutch. Two or three assistants held the victim, and he may have been given a sedative (mandrake or a sleeping sponge) saturated with a solution of opium hemlock or other soporific.

Operative procedure for the "little apparatus" consisted of inserting a finger into the anus, steady, ing the stone or pulling it down to a bulging perineum, cutting directly upon it and pressing from above or extracting with forceps. The "grand apparatus," probably the technique used on Pepys, was a modified Jacques's operation with grooved staff and scalpel, a lateral incision and division of the prostate.

Since diagnosis was still primitive and differential diagnosis doubtful the wise surgeon provided himself with a spare, an extra stone to foist upon the patient in case his efforts were unproductive. No small stone was ever cut out, for the patient naturally waited until his fear of the stone exceeded his fear of the cutting.

As a result of this operation some men went around with unhealed wounds, and some died of hemorrhage. Others lost control of the sphincter vesicae were left with urinary fistulas, or lost their procreative power through interference with the seminal vesicles and ducts. The mortality was 15 to 20 per cent.

It is no wonder then, that Pepys kept holy the anniversary of his operation nor that he edged the story of it into every possible conversation. Nor that his interest in urinary pathology was so aroused that he voluntarily attended a lecture at Chirurgeon's Hall and visited the dissection room where a certain Dr. Scarborough discoursed to him on the manner of the disease of the stone and the cutting and all other questions that I could think of.

Pepys's stone weighed about 2 ounces and was as large as a tennis ball. It was probably a uric acid calculus or had a uric acid nucleus with ammonium urate covering. Pepys kept it for years and even had a pretty case made for it. Immediate result of the ordeal was satisfactory, but Pepys continued to suffer from renal colic all his life. He tried to ward off attacks by keeping a hare's foot in his pocket. A friend told him that the foot's lack of a joint made it inefficient. How ever

It is a strange thing how fancy works for I no sooner almost handled his foot but my belly began to be loose and to break wind and whereas I was in some pain yesterday and 4 other day and in fear of more today I became very well and so continue."

When he died, an old man, his left kidney was found to be disorganized and contained seven calculi all fast linked together and weighing four ounces."

By injuring both his vasa deferentia, the operation left him sterile but not impotent. The *Diary* shows him to have been in a more or less constant state of sexual excitement. His unusual incontinence may have been due to the continual irritation of the old scar on the perineum. Freudian complexes to the contrary, some insignificant irritation may make all the difference between virtue and concupiscence.

When he crossed his legs carelessly a mild epididymitis ensued, much to his annoyance. And a sudden change from warm to cold weather would bring on severe pain—a probable reflex irritation from his kidney stones. In later life he seems to have been stricken with Bell's palsy and with something else that resembled pseudo-fleus, possibly another sort of reflex from his latent calculi. Everybody on the street witnessed his anguish and all the ladies sent in directions for enemas. The prescription that relieved him consisted of small beer.

Pepys's surgeon was Thomas Hollier lithotomist at St. Thomas's Hospital, and one time Warden of the Barber Surgeons' Company and later Master that same Hillyard who was called in to see Mrs. Pepys. Hollier had a reputation as a successful stone cutter, having cut thirty persons in one year without a death. It was fortunate for Pepys that Hollier's instruments had not yet become septic. Attending with Hollier were Dr. James Moleyne, lithotomist at St. Bartholomew's Hospital, and also Dr. George Joyliffe, who shares claim to the discovery of the lymphatics. The Sloane collection of manuscripts contains two subscriptions written for Pepys at the time of his operation. One of them reads:

For M. Peapys who was cut for the stone ye. 8 March. 658 and had very great stone taken that day from him.  
(Signed) Dr J M. Dr G Jolly

Its main constituent was lemon juice, to which a little syrup of radishes was added. Evidently Mr. Pepys was expected to have a little fever but was not thought to be seriously ill, for the prescription states that the mist. alba was to be sine moscho. At that time musk was considered to be the best remedy for grave illness, and few people died without a musk viaticum.

Dr. James Moleynes was Surgeon of the Stone at both St. Bartholomew's and St. Thomas's, and the College of Physicians granted him the unusual privilege of administering drugs in surgical diseases.

He signed the first prescription alone and with his initials, like a physician. Surgeons signed their full names.

In May 1660 Pepys had gone over to Holland with the ships which were to bring Charles II back to England. There was the usual royal salute with much firing of cannon. Holding my head too much over the gun, I had almost spoiled my right eye." Two years later at Portsmouth, Pepys "was much troubled in my eyes, by reason of the healths I have this day been forced to drink, and on returning to London he was let blood, about six ounces, by Dr. Hollier who received five shillings for his pains.

By 1664 Pepys was having eye pain after long reading or writing and made use of a globe of glass and a frame of oyled paper" to lessen glare. His experience was that of many another man in his thirties, when the strain of focussing, dependent upon some refractive error, has begun to send out SOS calls.

No mention of eye distress occurs in 1665, the year of the Great Plague and also a year of great naval activity. In May 1666 his right eye was sore and full of humour "a unilateral conjunctivitis, blamed upon "my late change of brewer. On December 24th he bought a pair of green spectacles. During 1667 only four entries suggest eye discomfort, but on November 4th he sought Trelington, the spectacle maker. In 1668 he consulted Turberville.

Turberville (D'Aubegney D'Urberville) had lately come up to London from Salisbury where he practiced as an oculist. The court physicians looked upon him as a country quack, and yet he was able to cure Queen Anne of sore eyes when she was a child. Oculists of that day founded their art on superstition and folk-lore, and knew little more than the corner drug-store clerk of today. They could make some simple but bunglesome refractions, and what cures they made were induced by chance. Their mercurial eye-washes may have helped heal venereal affections of the eye. And they had some knowledge of spectacles, such as they were, for both convex and concave lenses had long been discovered. But astigmatism was not recognized until 1827, and of simple accommodation men like Turberville knew nothing. Yet Turberville's tomb in Salisbury Cathedral bears this inscription,

"Near this place lies Interred the most expert and successful oculist that ever—as and perhaps ever will be.

It is not apparent that Turberville did much for Pepys. No pre-nineteenth century oculist could have done much. Sir D. Argy Power considers

Pepys's defect as hypermetropia with slight astigmatism. R. R. James thinks that much of the trouble was caused by muscle imbalance, possibly insufficiency of convergence. The spectacle maker would hardly have dissuaded him from the old spectacles, the higher plus spheres if a large hypermetropic error had been present, and Pepys himself admits that for a short reading period he could see as well as ever. That unocular vision in a tube relieved him is in favor of his defect being concerned with binocular vision.

Poor Pepys's inability to get proper spectacles brought him to the sad conclusion that he was going blind. His entry for May 31 1669 reads,

"And thus ends all doubt I shall ever be able to do with my own eyes in the keeping of my journal I being not able to do it any longer having done it now so long as to undo my eyes almost every time that I take a pen in my hand. And therefore whatever comes of it must forbear."

Of course, he did not lose his sight and as late as 1702 he was writing letters with his own hand though he preferred dictating them. The increasing sclerosis of the lenses prevented his readjusting their curves, and neutralizing the insufficiency and asymmetry of his corneal curvature. When he automatically gave up trying to do the impossible he got relief. He needed a pair of compound lenses—spheres for his long sight and cylinders for his coincident astigmatism.

Pepys's minor ailments included frequent indigestion and colds. Once he had tonsillitis from sitting sweating in the playhouse with the wind blowing through the windows on my head. And once he had a boil under my chin which troubled me cruelly.

The *Diary* records his interest in the King's Evil, in smallpox, and in the plague, the ravages of which he witnessed. As guest of chyrurgeon

Pierce he once witnessed a dissection of the genitourinary system. He also saw an early mastectomy. He was an intelligent observer of the first successful blood transfusion in dogs.

Sharing the current belief in tobacco as a plague preventive he tried out a 'chaw' one day and soon lost his sense of apprehension probably via the emesis that followed his unaccustomed use of the weed.

On the accession of William and Mary Pepys retired to his books and his music, to his correspondence with Sir Isaac Newton, Dryden and other sons of fame. And so to the grave in 1703 at the ripe age of seventy-one!

The exact necropsy findings are unknown but there was gross pathological evidence of arteriosclerosis. The calyces of the left kidney contained a nest of seven stones. Note is made of the scar on the perineum. There is a probability that he had prostatic hypertrophy resulting in urgency and frequency of urination rather than ordinary incontinence.

The importance of the postmortem lies in the fact that, for the first time an autopsy had been done on a colorful interesting character in English life—a circumstance that proved to be a valuable asset to the medical scientists of the period.

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## REVIEWS OF NEW BOOKS

IN the second edition of *Physical Medicine in General Practice*, the author has included the advances which were made in physical medicine during the last World War and the results of the work done by the National Foundation for Infantile Paralysis, as well as some of the newer subjects such as the combination of penicillin and fever therapy in syphilis and early ambulation in medical and surgical conditions. In the first fifteen chapters the physics and the physiological response of the tissues to the various modalities employed in physical medicine are discussed. The use of the modalities is described in sufficient detail so that a general practitioner can write an adequate prescription to enable the physical therapist to carry out accurate treatment. The chapters which deal with hydrotherapy and short wave diathermy are particularly well presented.

In the chapter on Medical Rehabilitation the author touches on all aspects of physical medicine and rehabilitation in the various types of conditions. This includes educational and vocational rehabilitation.

The last nine chapters of the book present diseases of the various body systems and the physical medicine measures which would be used as an adjuvant in their treatment. E. J. CONNORS, JR.

THE editors of *Principles of Occupational Therapy*, Helen S. Willard and Clare S. Spackman in collaboration with nineteen other authors, give a clear and complete description of the subject from the present day standpoint. The book is divided into two main sections. The first section deals with the basic concepts in occupational therapy, outlining its history, scope, and aims and including a chapter on organization of an occupational therapy department. The second section discusses the applied principles in various types of hospitals and, too, in dealing with various types of disease and injury. The various activities and the way in which they may be used in the treatment of specific illnesses or injuries are well presented. In addition many of the activities described may be useful in the care of the patient for recreation even though they cannot be classed as treatment. The chapter on occupational therapy for patients with physical injuries is particularly well done. The association between occupational therapy and physical therapy is also brought out in this chapter.

**PHYSICAL MEDICINE IN GENERAL PRACTICE.** By William Bierman, M.D. With a chapter on Medical Rehabilitation by Dr. Sidney Licht, M.D. and ed. New York and London: Paul B. Hoeber, Inc. 647.

**PRINCIPLES OF OCCUPATIONAL THERAPY.** Edited by Helen S. Willard, B.A., O.T.R. and Clare S. Spackman, B.S., M.S. in Ed. O.T.R. Philadelphia, London, Montreal: J. B. Lippincott Co. 947.

ter. The chapter on occupational therapy for patients with mental disease is especially good and it would appear that in this branch of medicine occupational therapy has its greatest usefulness. The educational aims of occupational therapy as presented are an excellent goal and would contribute considerably to the efficiency of occupational therapy in the treatment of patients. The final chapters of the book outline the organization and activities of occupational therapy in Army, Navy and Veterans' hospitals.

Particularly individuals having to do with the care of industrial or institutional cases would find this book of value. E. J. CONNORS, JR.

THE third edition of *Recent Advances in Sex and Reproductive Physiology* by J. M. Robson represents a revision of the 1940 edition and has a moderate amount of newly added material. It is concerned with sex and reproductive physiology of the female only. Sixty-five illustrations are listed but a good share of these are diagrams, tables, and graphs.

According to the foreword the book was written to answer the questions of perplexed physicians. The emphasis, however, is placed on the presentation of experimental animal data. For example, in the section on cyclic changes in the endometrium, the first half of the discussion is concerned with the mouse, rat, rabbit and bitch. The second half is devoted to primates, but man comes off a poor second in that most of the attention is devoted to the monkey. Some of the scanty human data could better have been omitted. Specifically a full page is devoted to the outmoded and erroneous descriptions by Shaw (1925) of the cyclic changes in the endometrium. Schroeder's description is included but the significant works of Robert Meyer and Emil Novak on this subject are ignored. In fact, the innocent reader is left with the impression that this particular subject is one that is obscure and subject to great controversy.

In general the author's citations are representative of data obtained from experimental animals, although the rabbit is obviously Dr. Robson's favorite experimental animal. He has however made a good effort to evaluate critically the animal data. For this reason the book will be of value to some laboratory workers. Its reference value is limited, however, by the incompleteness of its survey of the literature.

The reviewer doubts that the book would be of great value to the perplexed clinician. R. R. GREENE

**"RECENT ADVANCES IN SEX AND REPRODUCTIVE PHYSIOLOGY** By J. M. Robson, M.D., D.Sc. (Leeds), F.R.S.E. 3rd ed. Philadelphia and Toronto: The Blakiston Co., 947.

THE high caliber of the first four editions is maintained in the fifth edition of *A Textbook of Pathology, an Introduction to Medicine* by Dr William Boyd.

Again Dr Boyd has saved time for the cursory reader by outlining in his preface the new material which has been added to the content. This material has been well selected. As in previous editions emphasis is laid upon photomicrography which is adequate and illustrates the individual lesions satisfactorily. The photographs of gross specimens are well distributed. The chapter on diseases of the central nervous system and that of bones is especially well organized.

The reviewer sees one minor criticism that being an outmoded bibliography.

It would be advantageous if Professor Boyd could in his next edition add chapters on diseases of the skin, the eye and of the ear, nose and throat. Additional space might be devoted to the effects of heat and cold of physical trauma including blast injury and to the morphologic changes of radiation. These would enhance the value of this standard text.

M C WICKLOCK.

AN exhaustive treatise on cystitis and diseases of the urinary bladder has been written by Luis Cisuentes Delatte.<sup>1</sup> The author bemoaned the paucity in the literature of material on this subject and therefore conceived this work to fill in the skipped spots. He draws liberally upon what others have done and written before him from his own experience he supplies what was lacking to give a complete well rounded study of the inflamed bladder.

The book is divided into two parts. The first treats of general concepts regarding cystitis and cystopathies. The normal bladder mucosa is described and the departures from this normal mucosa are compared in the various bladder diseases. A chapter on etiology includes a study of the many bacteria which may cause cystitis their virulence, and the peculiar bladder reaction to the particular infection. Cystoscopic exploration and methods of obtaining biopsy material as well as general principles of treatment are given. The new chemotherapeutic and an ibiotic substances receive special emphasis. The various recognized classifications of cystitis are reviewed. These the author believes are inadequate. He proposes a classification which appears all inclusive and divides cystitis into primary and secondary. The former discusses bacterial, parasitic, viral, chemical, physical, and toxic. The latter takes up subjects as neoplasms, stones, malformations, trauma, fistulas and the like.

Cystopathies make up the third section of the classification. Among others such topics as cysts, leucoplasmia, allergies, amyloidosis and malacoplasmia are considered.

A TEXTBOOK OF PATHOLOGY, AN INTRODUCTION TO MEDICINE. By William Boyd, M.D. Dipl. Psych. M.R.C.P. Edin. F.R.C.P. Lond., J.L.D. Sask. M.D. Osk. F.R.S.C. 5th ed. Philadelphia. Lea & Febiger, 947.

\*CISTITIS Y CISTOPATIAS. By Luis Cisuentes Delatte. Madrid Editorial Paz Montalvo, 947.

The second part of the book is devoted to specific forms of bladder disease. Tuberculosis, gonorrhea, actinomycosis, bñharzia, and lymphogranuloma each have complete chapter discussions. Trigonitis is given emphasis proportionate to the importance of this disorder and alone makes the volume a valued possession.

The book has 176 illustrations. 82 of which are in color and depict the pathologic process in amazingly sharp detail. The volume is a credit not only to the Spanish medical literature but represents a positive advance in worldwide urologic conceptions.

STEPHEN A. ZIDMAN

THE third edition of the monograph on *Hernia* by Watson<sup>2</sup> deserves a place as a standard reference on the subject. All types of hernia are described with their chief symptoms, mechanism and recommended methods of treatment. Many illustrations are used to explain the text. The author is justifiably critical of many operative procedures and advised those methods which have been most widely accepted. He is quite opposed for example, to fascial suture repairs to which he objects as more traumatic than a carefully performed repair by means of fine suture material with or without fascial patch or cutis grafts.

There are many changes from the second edition. The author now advises silk or cotton suture instead of absorbable suture material. A new section on the repair of Cooper's ligament has been added. Early ambulation has been substituted generally for prolonged bed rest. Chapters have been added on the truss treatment of hernia and industrial hernia.

It seems unfortunate that a reference work otherwise so acceptable should have devoted so much space (68 pages) to the injection treatment of hernia. So far as the reviewer is concerned injection treatment should have been mentioned only to be condemned. The author's statement that in hernias previously treated by injections the dissection is a little difficult seems a gross understatement.

THOMAS C. DOUGLASS.

A comprehensive report on the cytological changes in the epithelial structure of the female generative tract is presented in *The Epithelia of Woman's Reproductive Organs*<sup>3</sup> by Drs. George N. Papanicolaou, Herbert F. Traut, and Andrew A. Marchetti. This study represents a co-operative effort by a group of workers with biologic, physiologic, and gynecologic interests and contributes to an understanding of functional characteristics of the female generative tract. The material for this study was obtained from the Woman's Clinic of the New York Hospital and

\*HERNIA. ANATOMY. ETIOLOGY. SYMPTOMS. DIAGNOSIS. DIFFERENTIAL DIAGNOSIS. PROGNOSIS AND TREATMENT. By Leigh F. Watson, M.D. F.R.C.S. 3rd ed. St. Louis C.V. Mosby Co. 1948.

\*THE EPITHELIA OF WOMAN'S REPRODUCTIVE ORGANS. By George N. Papanicolaou, M.D., Herbert F. Traut, M.D. and Andrew A. Marchetti, M.D. New York. The Commonwealth Fund, 948.

the monograph is based on a ten year study conducted by the Departments of Anatomy and Obstetrics and Gynecology of Cornell University.

The changes in the ovary are accurately described starting with the developing follicle and continuing through ovulation and corpus luteum development. The changes in the epithelia of the tubes, uterine mucosa, endocervical glands, portio vaginalis of the cervix and vagina are then correlated with the cyclic change which occurred in the ovary. The descriptive text frequently refers the reader to the section of the book containing the photomicrographs and the beautiful drawings of Hashime Murayama. These illustrations help to tell an important part of the story and for any student of the cytology of the female genital tract these drawings will be a great help in recognizing and identifying the cytologic changes which occur. A large colored chart at the close of the book serves to correlate all of the cytologic changes which occur in the various sections of the tract during each phase of the menstrual cycle. These authors have made a significant contribution which is well presented.

FRANCIS M. INKERHILL.

MANY new therapeutic agents in the treatment of diseases of the ear have been studied during the war period and are just now coming to the notice of the otologists. These have all been added to the second edition of Nelson's *Loose Leaf Medicine of the Ear* and undoubtedly will prove useful when applied to the civilian population. The chapter on otologic aspects of aviation should be helpful to otologists and aviation companies as well.

The book has not suffered from the delay caused by the war, in fact the delay has been useful in that it allowed time for the latest investigations to appear in print.

The book is printed on good stock and is profusely illustrated. It should prove a quick and ready reference for the latest work in medicine of the ear.

JOHN F. DILLON.

AN excellent condensation of the periodical literature for the year 1947 is presented in *The 1947 Year Book of Obstetrics and Gynecology* edited by J. P. Greenhill. The abstracts have been prepared with commendable clarity and faithfully portray the gist of the original work. The several illustrations are well chosen and well reproduced.

Dr. Greenhill's comments while presenting his personal views, with which there will naturally be occasional disagreement, are written in a pleasant conversational style.

During the many years of their publication the year books have almost become institutions in American medicine. They serve their purpose admirably in that they supply readers accurate summaries.

RECENT PAGES IN THE LOOSE LEAF MEDICINE OF THE EAR. Edited by Edmund Prince Fowler, J. M.D. Med. Sc.D. New York and Edinburgh: Thomas Nelson & Sons, 1947.  
1947 YEAR BOOK. OBSTETRICS AND GYNECOLOGY. Edited by J. P. Greenhill, M.D. Chicago: Year Book Publishers, Inc., 1947.

not only to the physician who is too busy to read all of the current journals but also to anyone who wants a comprehensive review of the work in any special field. This book is a worthy addition to its many predecessors.

JOHN W. HERRICK.

A NEW surgical outline which will appear in a series of volumes is being published under the title *British Surgical Practice*. The two editors-in-chief, Sir Ernest Rock Carling and J. Paterson Ross, have selected specialists in many fields and have given them a free hand in discussing the details concerning a host of problems confronting the average surgeon. Cursory examination of the first volume, without careful study of the introduction, immediately suggests unfavorable criticisms which are untenable after one has studied the introduction. The editors-in-chief state at the outset that the series of volumes is prepared for the many physicians who lack easy access to libraries or medical centers. The work is directed primarily to these surgeons and is not intended to expound the minute details of highly specialized techniques. The outline is established, nevertheless, to show the average surgeon what might be accomplished by a highly trained expert in a certain field, working under the best possible conditions. The editors hope that the series will serve as a guide to those to whom is entrusted the surgical care of any type of patient. They admit freely that the specialist will not find the work of great advantage in his own case, but they would suggest that there are indeed portions which might be profitable for the specialist to peruse. The editors hasten to caution medical students that the volumes are not intended especially for them but they point to the all too rare quality of simplicity which has been achieved primarily by having only masters in knowledge and in expository skill to write the outlines in each field.

One refreshing feature of this volume which we hope will be evident also in the forthcoming volumes is the exclusion of obsolete procedures even though they may have become famous because of the relative renown of some of the older masters. The editors-in-chief accept full responsibility for the subject material, but they caution the reader "bearing chosen our man, we should allow him to express his preferences without undue interference."

The first volume takes the reader from Abdominal Emergencies to "Autonomic Nervous System. The general setup of the volume is unusual in that the alphabetical arrangement is the primary means of listing subjects. This affords immediate and convenient access to descriptions of clinical phenomena and syndromes which might be puzzling the surgeon. The matter is thoroughly outlined in a consistent fashion. There is a profusion of excellent illustrations and a decided advantage is the marginal list

"BRITISH SURGICAL PRACTICE. Under the general editorship of Sir Ernest Rock Carling, F.R.C.S. F.R.C.P. and J. Paterson Ross, M.S. F.R.C.S. Vol. 1. London: Butterworth & Co., Ltd. St. Louis: The C. V. Mosby Co., 1947.

or label index which renders the work simplicity itself.

The chapter on abdominal emergencies is well done and treats of all of the important features without going into tiresome detail about any. The list of references is somewhat short but by referring to the articles mentioned, the reader will find further bibliography which will lead the way to rather complete discussion.

The chapter on abdominal incisions presents most of the conventional information with a few additions which are perhaps innovations to the American surgeon.

The chapter on abscesses appears notably lacking in a thorough discussion of modern chemotherapeutic adjuncts and antibiotics. Closer examination of this part of the chapter suggests that it is exactly the intention of the author his major premise is that the treatment of abscesses is always surgical drainage, and it is implied that the surgeon will do well to keep that thought uppermost rather than to lean on therapeutic aids at an improper time. This is just one example of a delightful British manner of writing which displays itself throughout the volume. The habit of understatement has a tendency to emphasize facts which the careful surgeon will have in mind and the style throughout is pleasant and makes for easy reading.

The chapter on actinomycosis is especially good and is accompanied by some excellent illustrations. The portion on treatment is most up-to-date and seems to be well in accord with the experience in various centers throughout the United States.

Considerable attention is given to adhesions and the author advocates a rather middle course in their treatment. The outline is followed in strictest detail here and protects the author from giving too much space to his own personal conclusions in regard to the importance of adhesions.

The adrenal glands come in for discussion afford a rather quick and easy outline for the surgeon who throughout his entire career probably will not encounter more than one or two cases in which he must operate on these organs. The illustrations here are excellent and the implications and declarations concerning interplay of the endocrine systems afford a good review even for those persons who are unusually well versed in this type of disease.

Several chapters are devoted to after-care which brings in a consideration of physical therapy. This will be of interest to surgeons although some of the views expressed may be controversial. Apparently the British method of postoperative follow up care is a little different from the American method in that the care is entrusted to physicians specializing in other fields. Of interest to the practitioner is the separate chapter on care after return to the home.

One disappointment in the chapter on postoperative complications has to do with vomiting, hiccups and abdominal distention. Most American surgeons are strong advocates of the Wangenstein method of suction drainage. Its value has been proved in

clinics too numerous to mention. Very little is said about this adjunct in this chapter in addition the comment is made that the only drugs that are effective in abdominal distention are the derivatives of opium. A very serious question may be raised here in light of recent work which tends to suggest that the derivatives of opium might well be contraindicated. The giving of purges or enemas in this condition is also controversial but, as the general editors stated in their introduction, it would be difficult to get people to agree on all points.

In the section dealing with thrombosis and embolism it is interesting to note that the particular author is an advocate for the "walking treatment" of thrombophlebitis which may be a controversial point considering current opinion in many American clinics. The comments on prophylaxis of thrombosis and embolism are rather disappointing in that heparin is the only preparation that is even mentioned. It may be that this part of the article was prepared some time before the volume went to press but it appears that the average American surgeon would have devoted considerably more space not only to heparin but to dicumarol and to ligation of femoral veins. The evidence now at hand in this country cannot be denied in regard to the efficacy of several of these measures.

In other portions of the volume interesting side lights on surgical practice are touched on briefly. These include such items as allergy and amebiasis as well as amyloidosis.

The chapter on amputations is as complete as is necessary and contains valuable information in regard to prosthesis and rehabilitation.

One of the strongest aspects of the entire volume is the section on anesthesia. This is well outlined and condensed and brings in the important points stressed by Lundy, McGill and other authorities. Regional and spinal anesthetic procedures are covered as fully as space would permit.

The chapter on artificial anus is brief enough to avoid argument but of necessity presents several pieces of apparatus which might raise some question in the minds of certain authorities. The experience in this country has been that there is no agreement about appliances and patent apparatus, and perhaps the less said the better.

A delightful surprise is the thorough discussion offered on appendicitis. After all the average surgeon who will be away from the large medical centers will be confronted by this problem perhaps more than by any other. The illustrations and suggestions, and the general outline bring out nothing particularly new but afford a clear résumé.

The author of the section on arteries has drawn heavily on anatomic studies and offers excellent illustrations in regard to the approach to various large vessels. The chances are that the occasional surgeon who has this volume handy can refer to it even in an emergency which this chapter suggests. There is included a discussion on aneurysm and fistula which of necessity is sketchy in places but at least offers a



picture of what the specialist can accomplish in ideal circumstances.

There is a rather long section on bone and joint surgery complete with suggestions for postoperative training including use of artificial limbs. This will be of great practical importance to isolated practitioners entrusted with the care of patients who need such training.

The section on asepsis and antiseptics is rather short, but implies a great deal more than space permits in the discussion. Fortunately the list of references for this part is rather complete and the serious student will be able to find fuller information with this list as a guide.

E. S. Jono, Jr

THE second volume in the series, *British Surgical Practice*, starts with the topic Backache and ends with Burns. It is difficult to review the entire volume in a short essay because of the wide variety of topics.

The several important chapters on bacteriology contain the necessary details, with a rather full outline of the important features. A discussion on penicillin coincides quite well with the accepted American views of today. Combined treatment with heparin and chemical agents is suggested in a short paragraph although it is not elaborated. This treatment has proved to be of considerable value in this country in certain infections. The sulfonamides are mentioned rather briefly but apparently are not held in as high regard as they still are in some parts of this country. There is a discussion on the anaerobic spore-bearing bacilli which is very timely in that these organisms must always be borne in mind. Now that the lessons of the war are receding into the background, it is well to call to mind some of the less common complications which cannot be overlooked. The usual sources of anaerobic infection are discussed and measures to overcome the complications resulting from such infections are mentioned as fully as space will allow. The importance of spores is emphasized and the types of wounds in which they are likely to be encountered are listed. In this regard there is a good discussion of the proper construction of an operating room as far as antiseptics and asepsis are concerned. The demonstrations of the apparent value of scrubbing of the hands for varying periods are somewhat primitive but nonetheless effective. The current authorities are all quoted and although the section on surgical technique is most brief there are enough good references for those who are seriously interested.

In a subsection entitled "Chemotherapy" there are several statements which should be subjected to challenge. An example is the impression one gets that the sulfonamides have little or no effect on gram-negative bacilli. It is still felt in American circles that the sulfonamides are definitely indicated occa-

sionally. Infections of the urinary tract with *Escherichia coli* still respond dramatically to sulfonamides, and there is good experimental evidence to show that peritonitis of the fecal type can be successfully combated with these preparations. In addition, the military doctors in the Pacific areas in World War II found that several of the dysentery-producing organisms were almost specifically susceptible to sulfadiazine. Fortunately this part of the text has a very thorough bibliography and there are arguments in support of most of the statements.

There are comments, with adequate illustration, in respect to "general management of the patient" which include discussion of the proper construction of beds, plaster jackets, and so forth. The inevitable problem of bedsores is discussed briefly. A group of miscellaneous biochemical tests are outlined, with a short discussion of their use, which will be of value to the physician who operates only occasionally and will probably also afford a rapid review for experts. There are a few sections dealing with complications, scarcely considered surgical, which the practitioner will encounter. Examples of these are bites and stings. Further in the text, there are other unsurgical topics, such as the blood-forming organs, leucemias, blindness, and high and low blood pressure.

A very strong section of this volume is the detailed discussion on the urinary bladder as regards injuries and neurogenic disturbances. This leads very logically to a discussion of tumors and operative technique of the bladder which is sufficiently thorough to serve as a guide to the physician who occasionally operates.

More up to date, perhaps than some parts of the book is the section on blood transfusion. There is a clear, concise outline on agglutinogens, transfusion reactions, the Rh factor and so forth.

There is a rather prolonged section on bones and their pathology, which includes a discussion of bone grafting. This is a bit out of the field of the general practitioner and is probably much too sketchy for the orthopedic expert. Many of the cases cited and illustrations offered are most interesting from the standpoint of pathologic curiosities, but scarcely of prime importance from the standpoint of the general practitioner. If as the introduction to the first volume suggests, the book is to be used as a ready reference to the isolated practitioner many of the topics under discussion in the chapters on bone will merely be academic aids in classifying the case when the practitioner refers the patient to the large medical center for his definitive care.

There is a detailed section on brain surgery. Fortunately the greater part of this section is devoted to practical applications alone. Although the chapters are written by neurosurgical experts, the material covers problems that will confront the general surgeon and occasionally the practitioner. The greatest stress is laid upon emergency and temporizing procedures with clear outlines and illustrations to emphasize the practical applications. Implied and pressed restrictions are obvious as to where the physician who occasionally operates should stop. In-

tably there is a discussion of brain tumor which is not particularly prolonged and which probably should stress a bit more the need for placing these patients in a category wherein they are to be cared for by experts only. Operations for decompression and for short-circuiting receive brief comment. The emergency treatment of lesions of the head is well outlined and there is a good discussion of surgical principles involved in cases of this type.

The section on carcinoma of the breast is rather short probably because most of the material is now well known even in remote places. The portion of this section dealing with pathology is rather too brief and there is little or no discussion of grading of malignancy which may be a reflection of the light in which that convenient method is held throughout the British Isles. One of the most important statements made in this chapter is the following: "Aspiration may be needed to confirm a diagnosis of a cyst, but the possibility that carcinoma may exist in the wall of a cyst must never be forgotten." In a discussion of radical mastectomy the indications and contraindications for the operation are much the same as those listed by authorities in the United States with one notable exception namely that of ulceration of the skin. Many authorities in the United States feel that radical mastectomy can still be accomplished with good results in the presence of some ulceration in certain cases. The conclusions about preoperative and postoperative roentgen therapy seem quite sound namely that radical operation first followed by roentgen treatment, will probably be best in a vast majority of cases. The author of this section touches upon simple mastectomy plus roentgen therapy. Some of the Continental surgeons now are swinging back to that treatment in a large percentage of their cases. The author still seems to feel that the radical procedure is preferable but is cognizant of the recent revival of the other method. Apparently some of the patients with far advanced disease are treated by means of simple mastectomy only as a palliative measure roentgen therapy being employed for obvious metastatic nodal tumors. Following this discussion there is a résumé of mastitis and infections of the breast which while brief is quite clear and to the point.

There is a short section on surgery of the lung as encountered in the treatment of bronchiectasis. Once again the question arises as to whether this type of surgical treatment is to be performed by the physician who occasionally operates or whether it might not be better to leave it to the thoracic surgeon who has all the accouterments for preoperative preparation and postoperative treatment.

E. S. JUDG JR.

THE two hundred and eighteen page monograph by Dr Noel A. Gillespie entitled *Endotracheal Anaesthesia*<sup>1</sup> is a revised and enlarged second edition. It includes a section on anesthesia problems

peculiar to thoracic operations and the technique of tactile oral intubation with 12 additional illustrations of apparatus. There is a foreword by I. W. McGill, Ralph Walters and Arthur Guedel.

The work describes the historical aspects of the subject with meticulous care and discusses in detail the theoretical and practical aspects of endotracheal intubations. After a short dissertation on insufflation technique the remaining portion is devoted to endotracheal inhalation anesthesia. The elementary fundamental facts of anatomy physiology pharmacology and pathology are stated but not elaborated upon.

This book is a practical guide to a clinical skill. It will serve as a foundation upon which "may be built improvements in principle and technique which will make endotracheal anesthesia an even more useful aid than has been found at the present in the desire to bring help to surgeons and comfort and safety to patients."

Wider availability of endotracheal anesthesia depends upon an increased supply of medical men conversant with the facts and skilled by long experience in the technique of intubating the trachea. It is the author's hope that this monograph may thus enable more patients to reap the benefits accruing both to surgeons and anesthetists from tracheal intubation.

There is included an excellent bibliography and references that will enable any reader sufficiently interested to refer readily to the original sources.

MARY KARP

A SMALL 350 page volume *Symposium on Medicolegal Problems*<sup>2</sup> is of great interest and practical importance. It is a report of the medicolegal symposium which in the fall of 1945 was conducted jointly by the Institute of Medicine of Chicago and the Chicago Bar Association. It presents some of the problems which call for a joint effort of the two professions. Each of the subjects is presented first from the medical and then from the legal point of view by qualified representatives of the two professions. The discussion from the floor makes for lively reading.

There is a discussion of the conduct of the expert witness in court and the abuses of medical testimony with a suggested remedy in the form of disciplinary proceedings against any doctor or lawyer responsible for any irregularities in the presentation of such testimony. Any questionable testimony will be investigated by a committee of the Medical or Bar Association. The subject of artificial insemination is aired completely in a second discussion with all the implications considered in the open discussion. The medicolegal problems involved in the practice of pathology constitute a third chapter and many points of interest are brought up. Aside from a thorough discussion of

<sup>1</sup>SYMPOSIUM ON MEDICOLEGAL PROBLEMS UNDER THE CO-SPONSORSHIP OF THE INSTITUTE OF MEDICINE OF CHICAGO AND THE CHICAGO BAR ASSOCIATION. Edited by SAMUEL A. LEVISON, M.D. Ph.D. Philadelphia, London, Mostel and J. B. Lippincott Co., 1945.

<sup>2</sup>ENDOTRACHEAL ANAESTHESIA. By Noel A. Gillespie, D.M.B.Ch., M.A.(Oxon.), M.D.(Wisc.), D.A.(R.C.S. Eng.). Madison, Wisconsin: The University of Wisconsin Press, 1945.



## SURGICAL SPECIALTIES

Panel discussions on the surgical specialties will be held on Friday afternoon from 1:30 to 4:45 o'clock. The panels will be held concurrently in the following fields: urology, orthopedic surgery, neurological surgery, gynecology and obstetrics, thoracic surgery, and plastic surgery. Programs are shown on succeeding pages.

## OPHTHALMOLOGY

An exceptionally interesting program is being planned for ophthalmologists, consisting of two evening sessions, three morning panel discussions from 9:00 to 10:30, and an evening session on Wednesday in which a combined program with the otorhinolaryngologists will be held.

Subjects for the Tuesday evening session will be "Tumors of the Eyelids and the Conjunctiva," "Partial Keratectomy and Diathermy Cauterization of the Ciliary Body for Glaucoma." At the Wednesday evening combined session the subject will be "Neoplasms of the Eyelids, Orbit, Nose and Accessory Sinuses: Treatment and Plastic Repair." Subjects for the Thursday evening session will be "The Use of Retrobulbar Alcohol Injection for Ocular Pain," "Retinal Detachment," and "Correlation of the Anatomic Factors Concerned in the Ophthalmoscopic Appearance of Retinal Hemorrhages."

The morning panel discussions will be on the following subjects: Surgical Management of (1) Acute Inflammatory Glaucoma, (2) Chronic Simple Glaucoma, (3) Congenital Glaucoma, on Tuesday; Congenital Cataract on Wednesday; and Surgery of the Oblique Muscles on Thursday.

## OTORHINOLARYNGOLOGY

The program in otorhinolaryngology will consist of two evening meetings, an evening session on Wednesday in which a combined program with the ophthalmologists will be held, and three morning panel discussions from 10:45 to 12:15. The fact that the morning panel discussions are planned to follow those on ophthalmology will enable surgeons who combine these specialties in their practice to attend both sessions.

The subjects for the evening meetings will be as follows: On Tuesday, "Effects of Streptomycin on Eighth Nerve Function," "Anatomical Considerations in Eye Surgery," and "Chronic Laryngeal Stenosis," on Thursday, "Present Day Status of Frenectomy Surgery," "Tumors of the Nasopharynx," "The Modern Management of Oro-antral Fistula," and "Surgical Treatment of Laryngeal Cancer." The subjects for the Wednesday evening joint session are listed under "Ophthalmology" and also on succeeding pages which carry the detailed programs.

The morning panel discussions will be on the following subjects: "Rehabilitation of the Hard of Hearing," on Tuesday; "The Preparation of the Surgical Patient and Postoperative Care," on Wednesday; and "Diseases of the Esophagus," on Thursday.

## SYMPOSIA ON CANCER

On Tuesday afternoon from 2:00 to 5:00 a Symposium on "Cancer Is Curable" will be held at which surgeons will report on series of cancer survivals without recurrence of from five to twenty five years, and the College will report the additions to its Archives of Cancer Cures.

On Wednesday afternoon from 2:00 until 5:00 o'clock a Symposium on Cancer with Dr. Grantley W. Taylor of Boston, chairman of the Cancer Committee, American College of Surgeons, presiding is scheduled. The subjects for discussion are: "Tumors of the Central Nervous System," "Cancer of the Stomach—A Survey of 1,004 Cases," "Lymphomas," "Early Diagnosis for Proper Treatment of Cancer of the Urinary Bladder," "Tumors of Parotid," and "Cancer of the Ovary." The list of subjects together with the speakers is published on page 374.

## SYMPOSIUM ON FRACTURES AND OTHER TRAUMAS

Dr. Robert H. Kennedy of New York, chairman, Committee on Fractures and Other Traumas, will preside at the Symposium on Fractures and Other Traumas which will be held on Tuesday from 2:00 to 5:00 p.m. An interesting program is being developed under Dr. Kennedy's direction. The program appears on page 374.

## HOSPITAL STANDARDIZATION CONFERENCE

The first formal session of the Clinical Congress will be the opening meeting of the twenty-seventh Hospital Standardization Conference at 10:00 o'clock on Monday morning, October 18. The preliminary plans for this meeting are outlined on a preceding page under the heading "General Assembly." The hospital conferences will continue on Monday afternoon with sessions following on Tuesday, Wednesday, and Thursday mornings, afternoons, and evenings.

Hospital administrators, members of governing boards, medical staff members, heads of the various hospital departments and their personnel, nurses, dietitians, medical records librarians, and many other persons directly concerned about hospital progress, will be interested in the discussions of current hospital problems.

Among the subjects which will be discussed at

the conferences will be the following: 'New Developments in Medical Science which Affect Hospital Administration,' 'Office Facilities for Doctors in Relation to the Hospital,' 'Hospital Public Relations,' 'Discussion of Current Hospital Advances,' 'Approaching a Solution to our Nursing Problems,' 'Financial Relations with Patients and Doctors,' 'Problems of Small Hospitals,' and "Progress Toward the Medical Center Concept." Tuesday evening will be devoted to a round table conference on Hospital Standardization. Wednesday evening to a forum for hospital trustees. Thursday evening to a forum on fundamental administrative problems with administrative interns and graduates of the schools of hospital administration as the participants and Wednesday afternoon to a joint session with the American Association of Medical Record Librarians.

Adding with the program are the following members of the Hospital Standardization Conference committee: Rita E. Heerman, superintendent, The California Hospital, chairman; Paul C. Elliott, superintendent, Hollywood Presbyterian Hospital and President, Southern California Hospital Council; Alden B. Mills, administrator, Huntington Memorial Hospital, Pasadena; Sister Alphonsine, R.N., superintendent, St. Vincent's Hospital, Los Angeles; and Arthur J. Will, superintendent of charities, County of Los Angeles.

#### COMMITTEE ON ARRANGEMENTS

The Committee on Arrangements for the Clinical Congress in Los Angeles has been well organized and is actively functioning. The membership follows:

##### General Committee

Donald G. Tolleson, M.D., F.A.C.S., *Chairman*  
 Hugh T. Jones, M.D., F.A.C.S., *Vice-Chairman*  
 Harold Lincoln Thompson, M.D., F.A.C.S., *Secretary-Treasurer*  
 Gilbert J. Thomas, M.D., F.A.C.S., *Regent of the College*  
 E. Vincent Aubrey, M.D., F.A.C.S.  
 Max W. Bay, M.D., F.A.C.S.  
 J. MacKenzie Brown, M.D., F.A.C.S.  
 Lawrence Chaffin, M.D., F.A.C.S.  
 A. Ray Irvine, M.D., F.A.C.S.  
 Maurice Kahn, M.D., F.A.C.S.  
 W. E. MacPherson, M.D.  
 B. O. Martinson, M.D.  
 Louis J. Regan, M.D.  
 Carl Roache, M.D., F.A.C.S.  
 Stafford Warren, M.D.

##### Committee for the Southern California Chapter

Ray B. McCarty, M.D., F.A.C.S., *Riverside*  
 Meredith G. Beaver, M.D., F.A.C.S., *Redlands*  
 Clarence E. Rees, M.D., F.A.C.S., *San Diego*  
 Carl G. Johnson, M.D., F.A.C.S., *Long Beach*  
 James H. Saint, M.D., F.A.C.S., *Santa Barbara*

#### Hospital Committee

The members of the hospital committee are listed on succeeding pages with the list of hospitals participating in the clinical program.

#### MEDICAL MOTION PICTURES

An appreciated feature of the Clinical Congress will again be the showing of medical motion pictures each day. The latest available pictures in surgery and related subjects will be presented. Special showings will be arranged of medical motion pictures in the fields of ophthalmology and otorhinolaryngology. Both sound and silent films will be shown, all of which will have been approved by the Committee on Motion Pictures. Some of the newer medical motion pictures now under production will be shown.

#### TECHNICAL AND SCIENTIFIC EXHIBITIONS

The Technical and Scientific Exhibits will occupy the Ballroom foyer, the Renaissance Room, and the Galleria of the Biltmore Hotel, according to present plans. Leading manufacturers of surgical instruments, x ray apparatus, sterilizers, operating room lights, ligatures, dressings, hospital apparatus and supplies of all kinds and pharmaceuticals, and publishers of medical books will be represented.

#### ENTERTAINMENT FOR LADIES AND GUESTS

The Committee on Arrangements is planning a most interesting program for the wives and other guests of Fellows who are attending the Clinical Congress. Among the events planned are motor tours in and around Los Angeles to include such attractions as the Huntington Library, Griffith Park Planetarium, Olivera Street, Chinatown, visits to Hollywood studios and homes of motion picture stars, and radio broadcasts. Tickets to the broadcasts will be available upon request only at the registration desk at the Biltmore Hotel.

There will be a separate charge for each of the entertainment events. Each Fellow who registers in advance will receive a card listing the entertainment activities which he must check, if he is interested, and return the card accompanied by personal check to cover the total amount to Mrs. Verne C. Hunt, Box 95, San Marino, California.

#### ADVANCE REGISTRATION

Surgeons who wish to attend the Congress should register in advance. Under a new plan, advance registration will greatly expedite the procedure of registering.

No registration fee will be charged Fellows whose dues are paid to December 31, 1947. For

endorsed Junior and Senior Candidates, the fee will be \$5.00. Non-Fellows who after individual consideration are permitted to register will pay a fee of \$10.00.

No registration fee will be required of initiates of the class of 1948.

#### HOTEL RESERVATIONS

It is desirable to make hotel reservations as early as possible because of the shortage of hotel rooms that prevails in Los Angeles as well as in other cities. In making these communications should be addressed to the Los Angeles Conven-

tion and Visitors Bureau care of the Los Angeles Chamber of Commerce, stating that you will be attending the Clinical Congress of the American College of Surgeons. All hotel reservations for the Clinical Congress are to clear through this Bureau. No correspondence should be sent directly to the hotels. A form for reservations was enclosed in the letter recently sent to Fellows. Choice of hotels may be designated. The hotels in Los Angeles require a deposit in advance.

There follows the list of member hotels, Convention and Visitors Bureau Los Angeles Chamber of Commerce.

### LOS ANGELES HOTELS

Rates (as of May 15 1948) Subject to change

	Double	Twin		Double	Twin
Alexandria, 210 West 5th St.	\$ 6.00 up	\$ 7.00 up	Hollywood Knickerbocker		
Ambassador			1014 Ivar St.	\$ 6.00 up	\$ 6.00
3400 Wilshire Blvd.	\$10.00-17.00	\$10.00-17.00	Hollywood Plaza,		
Biltmore, 515 South Olive St.	\$ 7.50-12.00	\$ 7.50-12.00	1637 No. Vine St.	\$ 4.00 up	\$ 4.50 up
Chancellor, 3101 West 7th St.	\$ 4.50- 6.00	\$ 4.50- 6.00	Hollywood Roosevelt		
Chapman Park,			7000 Hollywood Blvd.	\$ 7.00 up	\$ 8.00 up
3401 Wilshire Blvd.	\$ 6.00- 7.00	\$ 7.00- 8.00	Kipling,		
Clark, 426 South Hill St.	\$ 4.50- 5.00	\$ 5.50- 6.00	4077 West Third St.	\$ 3.00	\$ 3.50- 4.00
Commodore,			Lankershim,		
1203 West 7th St.	\$ 3.00- 3.50	\$ 4.00	230 West 7th St.	\$ 3.00- 4.50	\$ 4.50- 7.00
Elmer, 235 South Hope St.	\$ 3.00	\$ 3.00	Mayan, 3049 West 8th St.	\$ 4.00- 5.50	\$ 5.00- 5.50
Figueras,			Mayfair, 1256 West 7th St.	\$ 3.00 up	\$ 6.00- 7.00
939 South Figueroa St.	\$ 3.00- 4.00	\$ 5.00	Natick, 108 West 1st St.		
Gates, 6th and Figueroa Sts.	\$ 3.50- 6.00	\$ 3.50- 6.00	Roslyn, 111 West 5th St.	\$ 4.00- 8.00	\$ 4.50- 9.00
Gaylord, 3335 Wilshire Blvd.	\$ 7.50 up	\$ 7.50 up	San Carlos		
Hayward, 6th and Spring Sts.	\$ 5.00	\$ 5.00	507 West 5th Street	\$ 4.50	\$ 6.00
Hollywood Drake,			Savoy		
6724 Hollywood Blvd.	\$ 3.50 up	\$ 4.50 up	6th St. and Grand Ave.	\$ 3.50- 5.50	\$ 4.50- 5.00
Hollywood Hotel,			Town House		
Hollywood at Highland.	\$ 5.00- 6.00	\$ 5.00- 6.00	639 Commonwealth Ave.	\$14.00	\$14.00

### CLINICAL CONGRESS PROGRAM IN BRIEF

#### Monday October 18

8:00-12:00 Clinics and Demonstrations—Local Hospitals  
 10:00-12:30 General Assembly—Ballroom  
 1:30-3:00 Panel Discussion—Philharmonic Auditorium  
 2:00-4:00 Television, Surgical Specialties—Foyer Biltmore Bowl (Lower Level)  
 2:00- 5:00 Clinics and Demonstrations—Local Hospitals  
 2:00- 5:00 Hospital Conference—Ballroom  
 2:00- 5:00 Surgical Film Exhibition (General)—Biltmore Theater  
 3:30- 5:00 Panel Discussion—Philharmonic Auditorium  
 8:15-10:30 Presidential Meeting—Philharmonic Auditorium

#### Tuesday October 19

8:00-12:00 Clinics and Demonstrations—Local Hospitals  
 8:30-12:30 Forum on Fundamental Surgical Problems—Philharmonic Auditorium  
 8:30-12:30 Forum on Fundamental Surgical Problems—Ballroom

9:00-10:30 Panel Discussion Ophthalmology—Conference Room No. 1  
 9:30-12:30 Hospital Conference—Music Room  
 9:30-12:30 Surgical Film Exhibition (General)—Biltmore Theater  
 10:00-12:00 Television General Surgery—Foyer Biltmore Bowl  
 10:45-12:15 Panel Discussion—Otorhinolaryngology—Conference Room No. 1  
 1:30- 3:00 Panel Discussion—Philharmonic Auditorium  
 2:00- 4:00 Television Surgical Specialties—Foyer Biltmore Bowl  
 2:00- 4:00 Surgical Film Exhibition (L.E.N.T.)—Conference Room No. 1  
 2:00- 5:00 Hospital Standardization Conference—Music Room  
 2:00- 5:00 Symposium Cancer Is Curable—Ballroom  
 2:00- 5:00 Symposium on Fractures and other Traumas—Biltmore Theater  
 3:30- 5:00 Panel Discussion—Philharmonic Auditorium

- 7 00- 8 00 Surgical Film Exhibition (E.E.N.T.)—Conference Room No. 1  
 8 00- 30 Hospital Conference—Music Room  
 8 00- 30 Scientific Session, General Surgery—Philharmonic Auditorium  
 8 00-10 30 Scientific Session, Ophthalmology—Conference Room No.  
 8 00- 00 Scientific Session Otorhinolaryngology—Conference Room N 5

### Wednesday October 20

- 8 00- 9 00 Meeting of Cancer Committee—Conference Room No. 6  
 8 00- 00 Clinics and Demonstrations—Local Hospitals  
 8 30- 30 Forum on Fundamental Surgical Problems—Ballroom  
 8 30- 30 Forum on Fundamental Surgical Problems—Philharmonic Auditorium  
 9 00- 30 Panel Discussion—Ophthalmology—Conference Room N  
 9 00- 00 State and Provincial Executive Committees—Engineers' Club  
 9 30- 30 Hospital Conference—Music Room  
 9 30- 30 Surgical Film Exhibition (General)—Biltmore Theater  
 00- 00 Television, General Surgery—Foyer Biltmore Bowl (Lower Level)  
 100- 00 Stat and Provincial Credentials Committees and Committees on Applicant and Judiciary Committees.  
 45 5 Panel Discussion, Otorhinolaryngology—Conference Room No.  
 00- 00 Luncheon—Meeting of Board of Governors.  
 30- 30 Panel Discussion—Philharmonic Auditorium  
 00- 4 00 Surgical Film Exhibition (E.E.N.T.)—Conference Room No.  
 00- 4 00 Television Surgical Specialties—Foyer Biltmore Bowl (Lower Level)  
 00- 5 00 Symposium on Cancer—Ballroom  
 1 00- 5 00 Surgical Film Exhibition (General)—Biltmore Theater  
 100- 5 00 Hospital Conference—Music Room  
 3 30- 5 00 Panel Discussion—Philharmonic Auditorium  
 3 30- 5 00 Meeting of National and Regional Fracture Committees  
 7 00- 8 00 Surgical Film Exhibition (E.E.N.T.)—Conference Room N  
 8 00- 00 Combined Session, Ophthalmology and Otorhinolaryngology—Conference Room No.  
 8 00- 30 Scientific Session, General Surgery—Philharmonic Auditorium  
 8 00- 30 Hospital Conference—Music Room

### Thursday October 21

- 8 00- 3 00 Clinics and Demonstrations—Local Hospitals  
 8 30- 3 30 Forum on Fundamental Surgical Problems—Ballroom  
 8 30- 3 30 Forum on Fundamental Surgical Problems—Philharmonic Auditorium

- 9 00- 30 Panel Discussion, Ophthalmology—Conference Room No. 1  
 9 30- 3 30 Hospital Conference—Music Room  
 100- 3 00 Television, General Surgery—Foyer Biltmore Bowl  
 1 45 1 5 Panel Discussion, Otorhinolaryngology—Conference Room No.  
 1 30- 1 45 Adjourned Meeting, Governors—Ballroom  
 1 45- 3 00 Annual Meeting, Fellows—Ballroom  
 100- 4 00 Television, Surgical Specialties—Foyer Biltmore Bowl  
 2 00- 3 00 Hospital Conference—Music Room  
 2 30- 5 00 Surgical Film Exhibition (General)—Biltmore Theater  
 3 00- 5 00 Symposium, Graduate Training in Surgery—Ballroom  
 3 30- 5 00 Panel Discussion—Philharmonic Auditorium  
 3 00- 4 00 Committee on The Library—Conference Room No. 6  
 6 00- 8 00 Dinner for Committee on Fractures and Other Traumas and Chairmen, Regional Committees—Engineers' Club  
 7 00- 8 00 Surgical Film Exhibition (E.E.N.T.)—Conference Room No.  
 8 00- 3 00 Hospital Conference—Music Room  
 8 00-10 30 Scientific Session—General Surgery—Philharmonic Auditorium  
 8 00-1 30 Scientific Session—Ophthalmology—Conference Room No. 1  
 8 00- 30 Scientific Session—Otorhinolaryngology—Conference Room No. 8

### Friday October 22

- 8 00- 3 00 Clinics and Demonstrations—Local Hospitals  
 8 30- 3 30 Forum on Fundamental Surgical Problems—Ballroom  
 8 30- 3 30 Forum on Fundamental Surgical Problems—Philharmonic Auditorium  
 9 30- 0 30 Surgical Film Exhibition (E.E.N.T.)—Biltmore Theater  
 0 00- 2 00 Television, General Surgery—Foyer Biltmore Bowl  
 10 30-12 30 Surgical Film Exhibition (General)—Biltmore Theater  
 30- 2 15 Assembly of Initiates—Temple, Baptist Church  
 30- 4 45 Panel Discussions for each of the following: Gynecology and Obstetrics—Conference Room No. 1  
 Plastic Surgery—Ballroom  
 Neurological Surgery—Conference Room No. 1  
 Thoracic Surgery—Engineers' Club  
 Urology—Conference Room No. 9  
 Orthopedic Surgery—Biltmore Theater  
 2 00- 4 00 Television, Surgical Specialties—Foyer Biltmore Bowl  
 00- 5 00 Clinics and Demonstrations—Local Hospitals  
 7 30- 8 00 Assembly of Initiates for Processional—Temple Baptist Church  
 8 5 20 Convocation—Philharmonic Auditorium

## EVENING SCIENTIFIC SESSIONS

## GENERAL SURGERY

Tuesday 8 00-10.30 p m

*Symposium on Malignant Lesions of the Thyroid Gland*

Histologic Types of Thyroid Carcinoma and Their Clinical Significance FRANK W. FOOTE, M.D., New York.  
 Aberrant Thyroid. BRIEN T. KING, M.D., Seattle.  
 Malignancy in Nodular Goiter WARREN H. COLE, M.D., Chicago.  
 Radioactive Iodine for the Treatment of Thyroid Disease Including Carcinoma MYRON PRINZMETAL, M.D., Los Angeles.

Wednesday 8 00-10 30 p m

Fracture Oration. Colles' Fracture. HENRY C. MARBLE, M.D., Boston

*Symposium on Endometriosis*

Etiology of Endometriosis. BROOKS RANNEY, M.D., Chicago.  
 Surgical Procedures Involved in the Treatment of Endometriosis VIRGIL S. COUNSELLER, M.D., Rochester, Minnesota.  
 The Medical Treatment and Significance of Endometriosis JOE V. MEIGS, M.D., Boston

Thursday 8 00-10 30 p m

*Symposium on Surgery of the Heart and Great Vessels*

Surgical Treatment of Pulmonic Stenosis ALFRED BLALOCK, M.D., Baltimore.  
 The Surgical Treatment of Constrictive Pericarditis. EMILE F. HOLMAN, M.D., San Francisco.  
 The Surgery of Patent Ductus Arteriosus JOHN C. JONES, M.D., Los Angeles.  
 Treatment of Coarctation of the Aorta. ROBERT E. GROSS, M.D., Boston.

## OPHTHALMOLOGY

Tuesday 8 00-10 30 p m

Tumors of the Eyelids and the Conjunctiva. MICHAEL J. HOGAN, M.D., San Francisco.  
 Partial Keratectomy GEORGE L. KILGORE, M.D., San Francisco.  
 Diathermy: Cauterization of the Ciliary Body for Glaucoma. SAMUEL J. MEYER, M.D., Chicago

Thursday 8 00-10 30 p m

The Use of Retrobulbar Alcohol Injection for Ocular Pain ALFRED E. MAUMENEY, M.D., Baltimore.  
 Retinal Detachment. DOHRMANN K. FISCHER, M.D., San Francisco.  
 Correlation of the Anatomic Factors Concerned in the Ophthalmoscopic Appearance of Retinal Hemorrhages  
 HOMER E. SMITH, M.D., Salt Lake City

## OTORHINOLARYNGOLOGY

Tuesday 8 00-10 30 p m

Effects of Streptomycin on Eighth Nerve Function. PAGE NORTHINGTON, M.D., Oakland.  
 Anatomical Considerations in Ear Surgery J. BROWN FARRIOR, M.D., Tampa.  
 Chronic Laryngeal Stenosis. JOHN B. ERICH, M.D., Rochester, Minnesota

Thursday 8 00-10 30 p m

Present Day Status of Fenestration Surgery LEIGHTON F. JOHNSON, M.D., Boston.  
 Tumors of the Nasopharynx. HARRY C. ROSENBERGER, M.D., Cleveland.  
 The Modern Management of Oro-Antral Fistula RICHARD THOMAS BARTON, M.D., Beverly Hills.  
 Surgical Treatment of Laryngeal Cancer CHEVALIER L. JACKSON, M.D., Philadelphia.



## COMBINED SESSION—OPHTHALMOLOGY—OTORHINOLARYNGOLOGY

## PANEL DISCUSSION

Wednesday 8:00-10:30 p.m.

Neoplasms of the Eyelids, Orbit, Nose and Accessory Sinuses: Treatment and Plastic Repair.

Moderator GORDON B. NEW, M.D., Rochester, Minnesota.

Collaborators: AUBREY G. RAWLIN, M.D., San Francisco; EDMUND B. SPAETH, M.D., Philadelphia;

JOHN B. ERICH, M.D., Rochester, Minnesota; MICHAEL J. HOGAN, M.D., San Francisco.

## PANEL DISCUSSIONS

## GENERAL SURGERY

Monday 1:30-3:00 p.m.

*Acute Renal Failure in Surgical Patients*

Moderator: FREDERICK A. COLLIER, M.D., Ann Arbor

Collaborators: CHARLES D. CREEVEY, M.D., Minneapolis; ERNEST E. MUTHHEAD, M.D., Dallas; WILLIAM O. RUSSELL, M.D., Santa Barbara.

Monday 3:30-5:00 p.m.

*Tumors of the Mouth, Jaw and Face*

Moderator: GORDON B. NEW, M.D., Rochester, Minnesota.

Collaborators: LOUIS T. BYARS, M.D., St. Louis; J. ELLIOTT SCARBOROUGH, JR., M.D., Atlanta; ERNEST M. DALAND, M.D., Boston.

Tuesday 1:30-3:00 p.m.

*Low Lying Malignant Lesions of the Bowel*

Moderator: FRED W. RANKIN, M.D., Lexington.

Collaborators: R. KENNEDY GILCHRIST, M.D., Chicago; THOMAS E. JONES, M.D., Cleveland; JAMES GRAY, M.D., Toronto.

Tuesday 3:30-5:00 p.m.

*Evaluation of Liver Function in Relation to Surgery*

Moderator: NATHAN A. WOMACK, M.D., Iowa City

Collaborators: EVERETT I. EVANS, M.D., Richmond; ARTHUR H. BLAKEMORE, M.D., New York; JESSE L. BOLLMAN, M.D., Rochester, Minnesota.

Wednesday 1:30-3:00 p.m.

*Peripheral Arterial Disease*

Moderator: ALTON OCHSNER, M.D., New Orleans.

Collaborators: NORMAN E. FREEMAN, M.D., San Francisco; I. RIDGEWAY TRIMBLE, M.D., Baltimore; ROBERT R. LINTON, M.D., Boston.

Wednesday 3:30-5:00 p.m.

*Ulcerative Colitis*

Moderator: HENRY W. CAVE, M.D., New York.

Collaborators: ALBERT J. SULLIVAN, M.D., New Orleans; CLARENCE DENNIS, M.D., Minneapolis; CLAUDE F. DIXON, M.D., Rochester, Minnesota.

Thursday 3:30-5:00 p.m.

*Isotopes in Surgery*

Moderator: GEORGE M. CURTIS, M.D., Columbus.

Collaborators: EARL R. MILLER, M.D., San Francisco; JOSEPH G. HAMILTON, M.D., Berkeley; OLIVER COPE, M.D., Boston; BEVERLY C. SMITH, M.D., New York.

## SURGICAL SPECIALTIES, Friday 1 30-4.55 p m

## UROLOGY

Moderator: REED M. NESBITT M.D. Ann Arbor

*Present Day Management of Urinary Tract Infections*

Collaborators GRAYSON CARROLL, M.D. St. Louis WILLOUGHBY E. KITTREDOZ M.D. New Orleans  
GILBERT J. THOMAS M.D. Beverly Hills.

*The Clinical Management of Branched Renal Calculi*

Collaborators JAMES T. PRIESTLEY M.D. Rochester Minnesota RUBIN H. FLOCKS M.D. Iowa City  
THOMAS E. GIBSON M.D. San Francisco

## ORTHOPEDIC SURGERY

Moderator JOHN C. WILSON M.D. Los Angeles

*Mechanical Derangements of the Knee Joint*

Collaborators DOUGLAS D. TOPPELMER M.D. Oakland FRANCIS J. COX, M.D. San Francisco  
FRANCIS E. WEST M.D. San Diego

*Fractures About the Hip*

Collaborators J. SMITH NORMAN M.D. Pueblo JOHN J. LOUTZENHEISER, M.D. San Francisco JAMES  
K. STACK M.D. Chicago

## NEUROLOGICAL SURGERY

Moderator HOWARD C. NAFFZIGER M.D. San Francisco

*Cerebral Angiography*

Collaborators CARL F. LIST M.D. Grand Rapids EDWIN B. BOLDREY M.D., San Francisco EARL  
R. MILLER, M.D. San Francisco

## GYNECOLOGY AND OBSTETRICS

Moderator JOHN C. BURCH, M.D. Nashville.

*Hysterectomy Physiological Considerations—Indications*

Collaborators LANGDON PARSONS M.D. Boston CONRAD G. COLLINS, M.D. New Orleans R.  
GLENN CRAIG, M.D. San Francisco KARL H. MARTELLOFF M.D. Portland.

*Hysterectomy Technical Considerations—Complications*

Collaborators (Same as above)

## THORACIC SURGERY

Moderator FRANK S. DOLLEY M.D. Los Angeles

*Diagnosis and Surgical Treatment by Pulmonary Resection for Carcinoma Bronchiectasis and Tuberculosis*

Collaborators EVARTS A. GRAHAM M.D. St. Louis FRANK B. BERRY M.D. New York HERBERT C.  
MAIER, M.D. New York.

*Surgery of the Esophagus*

Collaborators RALPH H. ADAMS M.D. Louisville LYMAN A. BREWER III M.D. Los Angeles  
JOHN W. STRIEDER, M.D. Boston

## PLASTIC SURGERY

Moderator TRUMAN G. BLOCKER, JR. M.D., Galveston.

*Congenital Facial Deformities*

Collaborators DOUGLAS W. MACOMBER M.D. Denver WILLIAM S. KISKADDEN M.D., Los Angeles  
THOMAS D. CROMIN M.D. Houston WALLACE H. STEFFENSEN M.D. Grand Rapids.

*Burn Contractures of the Extremities*

Collaborators GEORGE V. WEBSTER M.D. Pasadena GERALD B. O'CONNOR M.D. San Francisco  
LOUIS T. BYARS M.D., St. Louis NATHANIEL B. SODERBERG M.D. Phoenixville Pennsylvania

## OPHTHALMOLOGY

Tuesday 9:00-10:30 a m

*Surgical Management of Glaucoma*

Moderator: A. RAY IRVINE, M.D. Los Angeles.

Collaborators HAROLD L. GOSS M.D., Seattle ROBERT A. SHAFFER M.D. San Francisco J. HEWITT  
JUDD M.D., Omaha.

Wednesday 9:00-10:30 a.m.

*Congenital Cataract*

Moderator OTTO BARKAN, M.D. San Francisco.

Collaborators S. RODMAN IRVING, M.D. Los Angeles HAROLD F. WHEALMAN, M.D. Los Angeles,  
RAYMOND J. NUTTING, M.D. Oakland.

Thursday 9:00-10:30 a.m.

*Surgery of the Oblique Muscles*

Moderator C. ALLEN DICKEY, M.D., San Francisco

Collaborators OWYEN H. ELLIS, M.D. Los Angeles AVERY MORLEY HICKS, M.D. San Francisco,  
ALFRED R. ROBBINS, M.D. Los Angeles

## OTORHINOLARYNGOLOGY

Tuesday 10:45 a.m.-12 15 p.m.

*Rehabilitation of the Hard of Hearing*

Moderator WALTER P. WORK, M.D., San Francisco

Collaborators HOWARD P. HOUSE, M.D., Los Angeles S. RICHARD SILVERMAN, M.D. St. Louis,  
HAROLD M. E. BOYD, M.D. Los Angeles.

Wednesday 10:45 a.m.-12 15 p.m.

*The Preparation of the Surgical Patient and Post-Operative Care*

Moderator COLBY HALL, M.D. Los Angeles.

Collaborators VICTOR GOODHILL, M.D. Los Angeles CHARLES F. MCCUSKEY, M.D. Los Angeles,  
HAROLD OWENS, M.D. Los Angeles.

Thursday 10:45 a.m.-12 15 p.m.

*Diseases of the Esophagus*

Moderator ALDEN H. MILLER, M.D., Los Angeles.

Collaborators SIMON JENBERG, M.D. Los Angeles LEWIS F. MORRISON, M.D. San Francisco,  
AMBROSE S. CHURCHILL, M.D. Los Angeles.

## SYMPOSIUM ON FRACTURES AND OTHER TRAUMAS

Tuesday 2:00-5:00 p.m.

ROBERT H. KENNEDY, M.D. F.A.C.S. New York, Chairman, Committee on Fractures and Other Traumas,  
Presiding.

Avulsions of the Skin. CARLETON MATTHEWSON, JR., M.D., F.A.C.S., San Francisco.

Secondary Closure of Wounds. HARRY C. BLAIR, M.D. F.A.C.S., Portland.

Care of Acute Amputations of the Fingers. WALTER C. GRAHAM, M.D. F.A.C.S., Santa Barbara.

Fractures of the Lower End of the Humerus in Children. JOHN C. WILSON, M.D. F.A.C.S., Los Angeles.

Acute Arterial Emergencies. JERR W. LORD, JR., M.D., F.A.C.S. New York.

Evaluation of Principles Concerned in Management of Trauma to the Kidney. LAZARUS A. ORSKOV, M.D.  
F.A.C.S. New York.

## SYMPOSIUM ON CANCER

Wednesday 2:00-5:00 p.m.

GRANTLEY W. TAYLOR, M.D. F.A.C.S., Boston, chairman, Cancer Committee, American College of Surgeons, presiding.

Tumors of the Central Nervous System. EDWIN B. BOLDREY, M.D. F.A.C.S. San Francisco, assistant  
clinical professor of surgery, University of California Medical School.Cancer of the Stomach: A Survey of 1004 Cases. STANLEY E. LAWTON, M.D. F.A.C.S. Chicago, assistant  
professor of surgery, University of Illinois (Rush) College of Medicine.Lymphomas. SIDNEY FARNER, M.D., Boston, assistant professor of pathology, Harvard University Medical  
School.Early Diagnosis for Proper Treatment of Cancer of Urinary Bladder. GILBERT J. THOMAS, M.D. F.A.C.S.,  
Beverly Hills, associate clinical professor of surgery (urology), University of Southern California School  
of Medicine.

Tumors of Parotid DANIEL P. SLAUGHTER, M.D. F.A.C.S. Chicago assistant professor of surgery University of Illinois College of Medicine.  
 Cancer of the Ovary JOSE V. MEZOS, M.D. F.A.C.S. Boston clinical professor of gynecology Harvard University Medical School

## PRESIDENTIAL MEETING

*Monday 8 15-10 30 p.m.—The Philharmonic Auditorium*

ARTHUR W. ALLEN, M.D. F.A.C.S. Boston President, American College of Surgeons Presiding  
 Processional—Officers, Regents and Distinguished Guests

Invocation

Address of Welcome

DOUGLAS G. TOLLEFSON, M.D. F.A.C.S., Los Angeles

Chairman, Committee on Arrangements

Introduction of Distinguished Guests

IRVIN ABELL, M.D. F.A.C.S. Louisville

Chairman, Board of Regents

Address of the Retiring President Looking Forward

ARTHUR W. ALLEN, M.D.

Inauguration of Officers

Presented by THOMAS E. JONES, M.D., F.A.C.S. Cleveland

Retiring First Vice President

President DALLAS B. PREMISTER, M.D. F.A.C.S. Chicago

First Vice President HOWARD A. PATTERSON, M.D. F.A.C.S. New York

Second Vice President CARL H. McCASKEY, M.D. F.A.C.S. Indianapolis

The Third Martin Memorial Lecture Some Aspects of the Development of Intrathoracic Surgery

CLARENCE CRAWFORD, M.D. Stockholm Sweden Professor of Surgery Karolinska Mediko-kirurgiska Institutet

## CONVOCATION

*Friday 8 15-10 30 p.m.—The Philharmonic Auditorium*

DALLAS B. PREMISTER, M.D. F.A.C.S. Chicago President, American College of Surgeons Presiding  
 Processional—Initiates Officers, Regents and Distinguished Guests

Invocation

Presentation of Initiates for Fellowship

IRVIN ABELL, M.D., F.A.C.S. Louisville

Chairman, Board of Regents

Fellowship Pledge. Recital by Initiates

Conferring of Fellowships by the President

DALLAS B. PREMISTER, M.D.

Conferring of Honorary Fellowships

The President

Fellowship Address The Physician Meets the Doctor

LEE A. DUBRIDGE, Ph.D., Pasadena, California

President, California Institute of Technology

Recessional

Reception by the Officers and Regents for the Initiates and Fellows

# ANNUAL MEETING, BOARD OF GOVERNORS OF THE COLLEGE

*Wednesday 12 15-2 00 p.m.—Ballroom The Biltmore Hotel*

DALLAS B. PREMISTER, M.D. F.A.C.S. Chicago President, American College of Surgeons Presiding

Statement by the Chairman of the Board of Regents

IRVIN ABELL, M.D. F.A.C.S. Louisville

*Brief Reports on the Activities, Problems, and Progress of the American College of Surgeons*  
 ARTHUR W. ALLEN, M.D., F.A.C.S., Boston, Immediate Past President  
 FREDERICK A. COLLIER, M.D., F.A.C.S., Ann Arbor, Regent  
 Discussion by Governors and Regents

## ADJOURNED MEETING BOARD OF GOVERNORS OF THE COLLEGE

*Thursday 1:30 p.m. — Ballroom, The Billmore Hotel*

DALLAS B. FREEMISTER, M.D., F.A.C.S., Chicago, President, American College of Surgeons, Presiding  
 Report of Committee on Nominations to the Board of Governors

## ANNUAL MEETING FELLOWS OF THE COLLEGE

*Thursday 1:45 3:00 p.m. — Ballroom, The Billmore Hotel*

DALLAS B. FREEMISTER, M.D., F.A.C.S., Chicago, President, American College of Surgeons, Presiding  
 Report of Committee on Nominations

Election of Officers and Governors of the College

Report of the Treasurer

DALLAS B. FREEMISTER, M.D., Chicago, Treasurer

EDWARD G. SANDROK, Comptroller

Cancer Committee

GRANTLEY W. TAYLOR, M.D., F.A.C.S., Boston, Chairman

Committee on Fractures and Other Traumas

ROBERT H. KENNEDY, M.D., F.A.C.S., New York, Chairman

Committee on Graduate Training in Surgery

FREDERICK A. COLLIER, M.D., F.A.C.S., Ann Arbor, Chairman

Hospital Department

Hospital Standardization

MALCOLM T. MACLACHERN, M.D., Associate Director

Graduate Training in Surgery

PAUL S. FERGUSON, M.D., Assistant Director, Hospital Activities

GEORGE H. MILLER, M.D., Director of Educational Activities

Sectional Meetings

MALCOLM T. MACLACHERN, M.D., Associate Director

H. PRATHER SAUNDERS, M.D., F.A.C.S., Associate Director

Credential Department

a. Credentials Committee

b. Committees on Applicants

c. Committee on History Reviews

H. PRATHER SAUNDERS, M.D.

Clinical Research

Medical Service in Industry

BOWMAN C. CROWELL, M.D., Associate Director

CHARLES F. BRANCH, M.D., Assistant Director

G. R. HESS, M.D., Assistant

Medical Motion Pictures

Publications

ELEANOR K. GRIMM, Administrative Executive

Library and Department of Literary Research

L. MARQUERITE PRIME, Director of Library and Department of Literary Research

Public Relations

LAURA G. JACKSON, Director of Public Relations

The American College of Surgeons Fellowship Obligations and Opportunities

IRVIN ABELL, M.D., Louisville, Chairman, Board of Regents

## PRELIMINARY CLINICAL PROGRAM

## PARTICIPATING HOSPITALS AND HOSPITAL CLINICS COMMITTEE

The California Hospital, Los Angeles—William F Quinn, M.D.  
 Cedars of Lebanon Hospital, Los Angeles—Adolph A. Kutzmann, M.D., F.A.C.S.  
 Children's Hospital, Los Angeles—J Norton Nichols, M.D., F.A.C.S.  
 French Hospital, Los Angeles—Pierre Paul Viole, M.D.  
 Glendale Sanitarium and Hospital Glendale—Eugene J Joergenson, M.D. F.A.C.S.  
 Hollywood Presbyterian Hospital—Olmsted Memorial—William H. Snyder, M.D. F.A.C.S.  
 Hospital of the Good Samaritan, Los Angeles—Francis M. McKeever, M.D.  
 Collis P. and Howard Huntington Memorial Hospital Pasadena—Leroy B Sherry, M.D. F.A.C.S.  
 Los Angeles County Hospital, Los Angeles—Clarence J Berne, M.D., F.A.C.S.  
 Methodist Hospital of Southern California, Los Angeles—Paul A. Quaintance, M.D. F.A.C.S.  
 Orthopaedic Hospital, Los Angeles—Ward M. Rolland, M.D. F.A.C.S.  
 Physicians and Surgeons Hospital Glendale—John R. Parton, M.D. F.A.C.S.  
 Queen of Angels Hospital, Los Angeles—Donald E. Ross, M.D., F.A.C.S.

St. Francis Hospital, Lynwood—Finis G. Cooper, M.D. F.A.C.S.  
 St. John's Hospital, Santa Monica—George Arnold Stevens, M.D. F.A.C.S.  
 St. Joseph Hospital, Burbank—Ralph H. Walker, M.D., F.A.C.S.  
 St. Luke Hospital, Pasadena—James M. Marshall, M.D., F.A.C.S.  
 St. Vincent's Hospital, Los Angeles—William P. Kroger, M.D., F.A.C.S.  
 Santa Fe Coast Lines Hospital, Los Angeles—Richard J. Flumson, M.D. F.A.C.S.  
 Santa Monica Hospital, Santa Monica—Leo J. Madsen, M.D. F.A.C.S.  
 U.S. Army McCormack General Hospital, Pasadena—Colonel Lawrence C. Ball, M.C., U.S.A.  
 U.S. Naval Hospital, Long Beach—Captain F. C. Hill, M.D.  
 U.S. Veterans Administration Birmingham General Hospital, Van Nuys—Joseph A. Weinberg, M.D., F.A.C.S.  
 U.S. Veterans Administration Center Wadsworth General Hospital, Sawtelle—Francis R. A. Byron, M.D. F.A.C.S.  
 White Memorial Hospital, Los Angeles—Clarence E. Stafford, M.D. F.A.C.S.

## CLINICS IN LOS ANGELES AND VICINITY HOSPITALS

## THE CALIFORNIA HOSPITAL, LOS ANGELES

## Tuesday

8:00-12:00. *General Surgery* Operative Clinics  
 Gastrointestinal Surgery—Vagotomy and Gastroenterostomy JACK M. FARRIS and ASSOCIATES.  
 Two Team Abdominal Perineal. MALCOLM R. HILL and ASSOCIATES.  
 Gastric Resections. WILLIAM F. QUINN, NORMAN L. CARDEY

## Wednesday

8:00-12:00. *General Surgery* Operative Clinics  
 Carcinomas of Face, Neck, and Breast. Los Angeles Tumor Institute Staff  
 Carcinoma of the Stomach. LEWIS A. ALLEN  
 Thoracic Surgery Operative Clinic  
 Carcinoma of Lung. LYMAN A. BREWER and ASSOCIATES.

## Thursday

8:00-12:00. *General Surgery* Operative Clinics  
 Lesions of Thyroid. O. DALE LLOYD  
 Cholecystic Disease. WILLIAM HENRY OLDS and ASSOCIATES.  
 Hernioplasty. FREDERICK W. LEIX and ANTON LAUBER SHICKLER.

## Friday

8:00-12:00. *Obstetrics and Gynecology* Operative Clinics  
 Total Hysterectomy. DONALD G. TOLLEFSON and ASSOCIATES.  
 Vaginal Hysterectomy. PAULA HORN and ASSOCIATES.  
 Total Hysterectomy. WILLIAM H. BROWNFIELD and ASSOCIATES.

Low Cervical Section and other Gynecological Procedures. RALPH J. THOMPSON, GEORGE W. HEWITT and AARON NEAL WEBB

## CEDARS OF LEBANON HOSPITAL, LOS ANGELES

## Tuesday

10:00-12:00. *General Surgery* Operative Clinic. Thyroidectomy. MAURICE G. KAHN, MAX W. BAY  
 10:00-12:00. *Gynecology* Operative Clinic: Selected cases. EMIL J. KRAHLIUCK.  
 10:00-12:00. *Genitourinary Surgery* Operative Clinic. Selected cases. JAMES STEINBERG.

## Wednesday

10:00-12:00. *General Surgery* Operative Clinic. Smithwick operation. MARCUS H. RABWIN  
 10:00-12:00. *Neurosurgery* Operative Clinic. Selected cases. TRACY PUTNAM.

## Thursday

10:00-12:00. *General Surgery* Operative Clinic. Abdominal surgery. ISAAC Y. OLCH.  
 10:00-12:00. *Gynecology* Operative Clinic. Selected cases. JOSEPH M. HARRIS, LEON KROHN  
 10:00-12:00. *Genitourinary Surgery* Operative Clinic. Selected cases. JAMES STEINBERG.

## Friday

10:00-12:00. *General Surgery* Operative Clinic: Selected cases. SAM S. HENRIKOFF  
 10:00-12:00. *Thoracic Surgery* Operative Clinic: Selected cases. ALFRED GOLDMAN

## Tuesday through Friday

10-12:00. *General Surgery* Nonoperative Clinics  
Smithwick Operation, Colectomy; Gall Bladder: Thyroid: Roentgenology: Pathology. MARCONI H. RABINOWITZ, DAVID H. ROSENTHAL, MAX W. BAY, ISAAC Y. OLICK, Members of Thyroid Committee, EDWARD FRIEDMAN, N. I. RICHMAN.

## CHILDREN'S HOSPITAL, LOS ANGELES

## Monday

*Thoracic Surgery* Operative Clinics  
Blacklock Operation: Bronchoscopies. JOHN C. JOHNS.  
*Oral Surgery* Operative Clinics  
Cleft Palates, Cleft Lips. EMIL F. THOMAS.  
*Orthopedic Surgery* Operative Clinics  
Iliz Fusion: Triple Arthrodesis: Biopsy of Knee. JOHN WILSON.  
12:00-1:00. *Thoracic Surgery* Nonoperative Clinics  
Patent Ductus Arteriosus: The Blacklock Operation.

## Tuesday

*Otolaryngology* Operative Clinics  
Tonsillectomy and Adenoidectomy: Mastoidectomy. ALDEN MILLER.  
*Plastic Surgery* Operative Clinics  
Pudgett: Grafts: Reconstruction: Ears, Excision of Nerve: Graft. WILLIAM S. KIRKADDER.  
*Ophthalmology* Operative Clinics  
Recession and Resection: Tuck and Recession, O'Connor: Cuneal Ptosis, Motz. A. RAY IVERSON.  
1:00-2:00. *Plastic Surgery* Nonoperative Clinic  
Immediate and Late Results Obtained in the Treatment of Burns.

## Wednesday

*General Surgery* Operative Clinics  
Herniorrhaphy: Orchiopexy, Appendectomy: Thyroidectomy: Cyst: LAWRENCE CHAFFIN.  
*Thoracic Surgery* Operative Clinics  
Coarctation, Patent Ductus. JOHN C. JOHNS.  
1:00-2:00. *General Surgery* Nonoperative Clinic  
General Pediatric Problems in Childhood.

## Thursday

*Genitourinary Surgery* Operative Clinics  
Nephrectomy: Bladder Neck Resection: Cystoscopies. O. W. BUTLER.  
*Orthopedic Surgery* Operative Clinics  
Spinal Fusion: Arthrodesis (Britton type). JOHN C. WILSON.  
*Proctology* Operative Clinic  
Rectovaginal Fistula. KENNETH E. SMILEY.  
*Endoscopy* Operative Clinics  
Bronchoscopy: Laryngoscopy. ALDEN MILLER.  
*Neurosurgery* Operative Clinics  
Cerebellar Exploratory: Choroid Plexectomy: Diencephalic. CARL W. RAMM.  
1:00-2:00. *Orthopedic Surgery* Nonoperative Clinic  
Clinical Diagnostic Problems.  
*Neurology* Nonoperative Clinic  
Brain Tumors in Childhood.

## Friday

*Otolaryngology* Operative Clinic  
Tonsillectomy and Adenoidectomy. ALDEN MILLER.  
*General Surgery* Operative Clinics  
Typhloplasty: Herniorrhaphy. WILLIAM J. NORRIS, JAMES NORTON NICHOLS.

*Ophthalmology* Operative Clinics  
Recession and Resection: Exotropia: Ptosis. A. RAY IVERSON.  
11:00-12:00. *Ophthalmology* Nonoperative Clinic  
Squint and Muscle Surgery.  
*Otolaryngology* Nonoperative Clinic  
Acute Obstructive Laryngitis.

## FRENCH HOSPITAL, LOS ANGELES

## Wednesday

10:30-11:30. *Tumor Surgery* Nonoperative Clinic: Radical Cancer Surgery of Head and Neck—slides—cases. SAM L. PERLITZ.  
11:30-12:30. *Tumor Surgery* Nonoperative Clinic: Combined Attack of Cancer of Head and Neck—slides—cases. CLYDE K. EMERY.  
1-2:00. *Tumor Surgery* Nonoperative Clinic: High Tumors of Neck—slides. ALICE POLLAK.  
2:30-3:30. *General Surgery* Nonoperative Clinic: Removal of Thyroglossal Duct Cyst—motion picture. ELMER J. BALL.

## Wednesday Afternoon

Round Table Discussion. ARTHUR J. MCKENNEY, FRED GASPARD, IVO LOWENBERG, VICTOR CHAIK, PIERRE PAUL VIOLE.

## HOLLYWOOD PRESBYTERIAN HOSPITAL—OLIMSTED MEMORIAL

## Tuesday

8:00-10:00. *Tumor Surgery* Nonoperative Clinic  
Cases Presented with Followup. C. IRVING WATSON and STAFF.

## Wednesday

8:00-10:00. *Tumor Surgery* Operative Clinic  
Radical Mastectomy with Chemo. C. IRVING WATSON and STAFF.  
10:00-12:00. *Genitourinary Surgery* Operative Clinic  
Urological Surgery. STAFF.  
12:00-2:00. *General Surgery* Operative Clinics  
Thyroidectomy: Gallbladder Resection: Lobectomy: Stomach. 2:00-3:00. *General Surgery* Nonoperative Clinic  
Nonsurgical treatment for Genital Reformation including Urinary Incontinence with Exhibit. ALBERT R. KROGER.  
3:00-4:00. *General Surgery* Nonoperative Clinic  
Traumatic Injuries to Abdomen. DONALD C. COLEMAN.

## Thursday

8:00-10:00. *General Surgery* Operative Clinic  
Selected Cases. STAFF.  
10:00-11:00. *Plastic Surgery* Operative Clinic  
Mastopexy: HERBERT OTTO BAKER.  
11:00-12:00. *Plastic Surgery* Nonoperative Clinic  
Demonstration Plastic Technique. HERBERT OTTO BAKER.

## HOSPITAL OF THE GOOD SAMARITAN, LOS ANGELES

## Tuesday

8:00-10:00. *General Surgery* Operative Clinic: Selected Cases. LAWRENCE CHAFFIN, WILLIAM J. NORRIS.  
10:00-12:00. *Thoracic Surgery* Operative Clinic: Selected Cases. JOHN C. JOHNS.  
12:00-1:00. *Neurosurgery* Operative Clinic: Selected Cases. GEORGE H. PATTERSON.

## Wednesday

- 8:00-12:00 General Surgery Operative Clinic Selected Cases PHILIP J. CUNYANT  
 8:00-12:00 Genitourinary Surgery Operative Clinic Selected Cases KENNETH F. SMITH  
 8:00-12:00 Vascular Surgery Operative Clinic Selected Cases CARL W. RAMP  
 9:00-12:00 Ophthalmology Operative Clinic Selected Cases GEORGE P. LANDFAGER

## Thursday

- 8:00-12:00 General Surgery Operative Clinic Selected Cases CLARENCE J. BERNZ, JAMES A. NICHOLS, KENNETH F. SMITH  
 8:00-12:00 Thoracic Surgery Operative Clinic Selected Cases FRANK S. DOLLEY  
 Otolaryngology Operative Clinic Selected Cases P. SHUMAKER

## Friday

- 8:00-12:00 General Surgery Operative Clinic Selected Cases LAWRENCE CHAFFIN  
 8:00-12:00 Genitourinary Surgery Operative Clinic Selected Cases WILLIAM H. KIDDER  
 8:00-12:00 Gynecology Operative Clinic Selected Cases HENRY M. SHAW  
 8:00-12:00 Orthopedic Surgery Operative Clinic Selected Cases JOHN C. WILSON

## COLLIS F. AND HOWARD HUNTINGTON

## MEMORIAL HOSPITAL, PASADENA

- Tumor Surgery Operative Clinic  
 Selected Cases GEORGE S. STARR, EUGENE W. DEMAREE  
 Plastic Surgery Operative Clinic  
 Correction of Burn Contractures. GEORGE A. WEBSTER  
 Gas Therapy Operative Clinic  
 Application of Intermittent Positive Pressure Breathing for Control of Respiratory Depression. JOHN B. DILLON  
 Orthopedic Surgery Operative Clinic  
 Early Recognition and Treatment of Congenital Hip. JOSEPH CHARLES RISSER  
 General Surgery Operative Clinic  
 Abdominal Surgery in the Aged and Portacaval Anastomoses in Cirrhosis of the Liver ARTHUR C. PATTISON  
 Pathology Nonoperative Clinic  
 Tumors and Cysts of the Ovary—A Pathologic Demonstration. ALVIN C. FOORD  
 General Surgery Nonoperative Clinic  
 The Cardiac Risk in Surgery. GEORGE GRIFFITH  
 Tumor Surgery Nonoperative Clinic  
 Tumor Clinic Demonstration—Selected Cases to Show the Operation of a Diagnostic Tumor Clinic in a Voluntary Hospital. EDWARD D. KREMER and STAFF

## LOS ANGELES COUNTY HOSPITAL,

## LOS ANGELES

## Monday

- 9:00 General Surgery Nonoperative Clinics  
 Symposium on Esophageal and Gastric Disease HAROLD LINCOLN THOMPSON  
 Surgery of Carcinoma of the Esophagus. LYMAN A. BREWER  
 Hiatus Hernia, Surgical Management JOSEPH L. ROBINSON  
 Vagus Resection in Treatment of Peptic Ulcer JOSEPH A. WERNER  
 Surgical Management of Massive Hemorrhage from the Upper Gastrointestinal Tract. E. ERIC LARSON

The Need of More Radical Surgery in Gastric Carcinoma  
HAROLD LINCOLN THOMPSON

## Tuesday

- 8:00 Genitourinary Surgery Operative Clinics  
 Intra- and Extracapsular Prostatectomy TRACY O. POWELL  
 Transurethral Prostatic Resection. ROGER W. BARNES  
 Thoracic Surgery Operative Clinic  
 Pneumothorax FRANK S. DOLLEY, LYMAN A. BREWER  
 Thoracic Surgery Nonoperative Clinic  
 Discussion on Problems of Anesthesia in Thoracic Surgery JOHN DILLON  
 Genitourinary Surgery Operative Clinic  
 Bilateral Nephrectomy for Carcinoma of the Bladder and the Metastasis SAMUEL L. PERLAK, LEWIS W. HAZARD  
 Discussion on Surgery of the Problem of Intraoral Cancer M. D. NALD  
 General Surgery Operative Clinics  
 Radical Mesorectal LAWRENCE CHAFFIN  
 Discussion on Surgery PHILIP J. CUNYANT  
 Thoracic Surgery PHILIP J. CUNYANT  
 Thoracic Surgery LAWRENCE CHAFFIN  
 Partial Gastrectomy ARTHUR C. PATTISON  
 Discussion on Lung Surgery WILLIAM H. SKYDER  
 Thoracic Lung Surgery ARTHUR C. PATTISON  
 General Surgery Nonoperative Clinics  
 Physiological Symposium CONRAD J. HACHGARTNER, Moderator

- Hazard of Thyroidectomy LEWIS F. JILLMORE  
 Organisms in the Levels Observed in Diagnosis and Treatment of Thyroid Disease EUGENE J. JEROME  
 The Problem of the "Metastatic Thyroid" CLARENCE J. BERNZ  
 The Newer Anti-Thyroid Drugs PAUL STARR  
 The Use of Radioactive Iodine in the Treatment of Thyroid Disease MYRON PRINZMETAL  
 Genitourinary Surgery Nonoperative Clinics  
 Discussion of Methods of Prostatectomy TRACY O. POWELL, Moderator  
 Endoscopic Identification of Tissue during Transurethral Prostatic Resection (lantern slide demonstration) ROGER W. BARNES, Moderator  
 10:00 Genitourinary Surgery Operative Clinics  
 Nephrolithotomy ADOLPH A. KUTZMANN  
 Transurethral Resection of Bladder Tumor R. THEODORE BERGMAN  
 11:30 Genitourinary Surgery Nonoperative Clinics  
 Discussion of Renal Surgery for Stone. ADOLPH A. KUTZMANN  
 Discussion of Endoscopic Treatment of Bladder Tumor R. THEODORE BERGMAN

## Wednesday

- 8:00-12:00 General Surgery Operative Clinic  
 Gastric Resection E. ERIC LARSON  
 Discussion during surgery CLARENCE J. BERNZ  
 General Surgery Nonoperative Clinics  
 Problem of Gastric Surgery in a Private Hospital Types of Resection Operative Morbidity and Mortality—Results  
 General Surgery Operative Clinics  
 Common Duct Stone. CLARENCE J. BERNZ  
 Discussion during surgery JOHN R. PATTON  
 Vagotomy and Gastroenterostomy EUGENE J. JOHNSON



- Results of Vagotomy t Los Angeles County General Hospital. HARRY C. PROUT
- General Surgery** Nonoperative Clinic  
Causes of Upper Gastro-Intestinal Bleeding (Illustrated) HAROLD LINCOLN THOMPSON
- General Surgery** Operative Clinic  
Resection of Lesion of Cardiac End of Stomach. HAROLD LINCOLN THOMPSON
- Discussion during surgery. EUGENE J JOHNSON
- General Surgery** Non operative Clinic  
Problems of Anesthesia in Thoracoabdominal Approach to Cardia. End of Stomach. JOHN B. DILLON.
- Proctology** Operative Clinics  
Repair of the Incontinent Anal Sphincter. PAUL C. BLAINDELL.
- Anal fissure. PAUL C. BLAINDELL.
- Abdominoperineal Resection—Two-term. MALCOLM R. HILL and AMOS TEE.
- Obstetrics and Gynecology** Operative Clinics  
Vaginal Hysterectomy. CARL E. KROEMER.
- Discussion during surgery. WILLIAM C. BRADBURY
- Total Hysterectomy. WILLIAM C. BRADBURY
- Discussion during surgery. CARL E. KROEMER.
- Orthopedic Surgery** Operative Clinics.  
Spinal Fusion. JOSEPH CHILDS RUMPER.
- Discussion during surgery. G. MONTAGUE TAYLOR.
- Intra-trochanteric Fracture The Newfield Nail. G. MONTAGUE TAYLOR
- Discussion during surgery. ALONZO J. NEUFELD.
- Orthopedic Surgery** Nonoperative Clinics  
Discussion between cases—Anatomical Considerations of the Region of the Hip. CHRISTOPHER MARSH, Moderator
- Problems of Anesthesia. JOHN B. DILLON.
- 9:30 **Tumor Surgery** Nonoperative Clinics  
Malignancy Symposium. IAN MACDONALD, Moderator  
Combined Procedures for Intraoral Cancer. 1st Cervical Metastases. LEWIS W. GUTH, SAMUEL L. PERLITZ.
- Detection and Management of Biologically Inoperable Mammary Carcinoma. LEO M. LEVI
- Diagnosis and Treatment of Uterine Carcinoma (Cervix, Corpus). JUSTIN J. STEIN.

#### Thursday

- 8:00—10:00. **Obstetrics and Gynecology** Operative Clinics  
Suspension of Vaginal Vault from Abdominal Route. HENRY N. SIKW.
- Manchester Operation. HAROLD K. MARSHALL.
- Pretermal Neurotomy. ERIC HENRIKSEN
- Gynecological Surgery** Operative Clinics  
Nephrectomy (th discussion) JAY J. CRAKE.
- Retroperitoneal Prostatectomy. SAMUEL A. BACON. FREDERICK A. BERNHART.
- Perineal Prostatectomy. CARL F. RUTCHIE, DONALD A. CHARNOCK.
- Thoracic Surgery** Operative Clinic  
Lobectomy. JOSEPH L. ROBINSON
- Discussion during surgery. JOHN C. JOSEPH.
- Vascular Surgery** Operative Clinics  
Thoracolumbar Sympathectomy. RUFERT B. RANNEY
- GEORGE H. PATTERSON
- Cervical Disc. AIDAN A. RANNEY. HERBERT G. CROCKETT
- Brain Tumor. PHILIP J. VOGEL, FRANK M. ANDERSON
- Suprathypharyngeal Sympathectomy (Pret Operation) EMIL SKLETZ, HENRY MICHAEL CUNEO.
- General Surgery** Operative Clinics  
Thyroidectomy. CLARENCE E. STAFFORD.
- Discussion of Thyroid Problems. CONRAD J. BAUMGARTNER.

- General Surgery** Nonoperative Clinics  
Discussion—Differential Diagnosis of Tumor of the Kid (Illustrated. 1th charts and models).
- General Surgery** Operative Clinics  
Bronchial Fistulotomy. CONRAD J. BAUMGARTNER
- Discussion of Congenital Lesions of the Kid. CLARENCE E. STAFFORD.
- 9:30. **Orthopedic Surgery** Nonoperative Clinics  
Fractures. VICTOR P. THOMPSON, Moderator
- Fractures and Dislocations of the Hip, Fracture of the Femur. Fracture of the Tibia. SAMUEL A. BACON, PAUL E. McMASTER, G. MONTAGUE TAYLOR, ALONZO J. NEUFELD.

#### Friday

- 8:00—10:00. **Proctology** Operative Clinics  
Abdominoperineal Resection. ROBERT L. BELL, WILLIAM H. DANIEL.
- Fistulotomy
- Hemorrhoidectomy
- Anal Uter Excision.
- Orthopedic Surgery** Operative Clinics.  
Amputation. FRANK M. McKEEVER.
- Open Reduction Fractured Tibia. P. CL. E. McMAHON
- Osteotomy of Hip. VICTOR P. THOMPSON.
- Discussion between cases.
- Tumor Surgery** Operative Clinics  
Radical Mastectomy. EUGENE J. JOHNSON.
- Discussion of Cancer of Breast. JUSTIN J. STEIN
- Tumor Surgery** Nonoperative Clinics  
Biopsy Techniques—Discussion between cases. CLARENCE E. NEELSON.
- Tumor Surgery** Operative Clinics  
Radical Neck Dissection. JUSTIN J. STEIN.
- Discussion during surgery. CLARENCE E. NEELSON.
- EUGENE J. JOHNSON.
- General Surgery** Nonoperative Clinics  
Anatomy of Inguinal and Femoral Regions (Demonstration with charts). COL. LAWRENCE BALL, GORDON K. SMITH.
- General Surgery** Operative Clinics  
Surgical Repair of Indirect Inguinal Hernia. COL. LAWRENCE BALL, GORDON K. SMITH.
- General Surgery** Nonoperative Clinics  
Survey of Hernia Repair. McCormack General Hospital and Los Angeles County General Hospital from Jan. 1946 to June, 1948 (charts and discussion). COL. LAWRENCE BALL, GORDON K. SMITH.
- General Surgery** Operative Clinics  
Surgical Repair of Direct Inguinal Hernia. COL. LAWRENCE BALL, GORDON K. SMITH.
- General Surgery** Nonoperative Clinics  
General Discussion of Anesthesia in Elective and Emergency Surgical Procedures for Repair of Hernia. JOHN B. DILLON.
- General Surgery** Operative Clinics  
Surgical Repair of Femoral Hernia. COL. LAWRENCE BALL, GORDON K. SMITH.
- General Discussion.
- General Surgery** Operative Clinics  
Obstructive Jaundice (Stone Common Duct). JOHN NORTON NICHOLS.
- General Discussion. LEWIS A. ALBERT.
- General Surgery** Nonoperative Clinics  
Discussion between cases—The Problem of Diagnosis of the Acute Abdomen in Children (Illustrated). JOHN NORTON NICHOLS.
- General Surgery** Operative Clinics  
Subtotal Gastrectomy Illustrating Use of Alcock Tube. LEWIS A. ALBERT.

Discussion during surgery JAMES NORTON NICHOLS.  
*General Surgery* Nonoperative Clinic  
 Symposium on Fluid, Nitrogen, and Electrolyte Balance  
 CLARENCE J. BERNZ Moderator  
 General Review of Current Concepts. JACK M. FAR-  
 RIS  
 Discussion of Nitrogen Balance. HARRY A. DAVIS.  
 Discussion of Acid Base Balance. RALPH E. HOMANN  
 Presentation of Illustrative Cases. HELEN E. MARTIN

METHODIST HOSPITAL OF  
 SOUTHERN CALIFORNIA, LOS ANGELES

Monday

8:00-12:00 *Thoracic Surgery* Operative Clinic  
 Selected Cases. LYMAN A. BREWER, FRANK S. DOLLEY  
 8:00-12:00. *Tumor Surgery* Operative Clinic Selected  
 Cases. CLYDE EMERY TUMOR GROUP. SAMUEL L. PERLIT.  
 8:00-12:00. *Orthopedic Surgery* Operative Clinic. Selected  
 Cases. HAROLD E. CROWE, KENNETH TOWNSEND.  
 8:00-12:00. *Ophthalmology and Otolaryngology* Operative  
 Clinic: Selected Cases. WALTER R. CRANE.

Friday

8:00-12:00 *Genitourinary Surgery* Operative Clinic  
 Selected Cases. FREDERICK A. BENNETT, CARL L.  
 MULFINGER.  
 8:00-12:00. *Obstetrics and Gynecology* Operative Clinic  
 Selected Cases. ALEX A. BLATHERWICK, CARL E. KRUG-  
 MEIER, ELDON W. TICE.  
 8:00-12:00. *General Surgery* Operative Clinic Selected  
 Cases. CLIFFORD O. BIRCH, GEORGE R. DUNLEVY,  
 LEWIS F. ELLMORE, ADOLPH M. HANSEN, ELMER A.  
 NELSON, ROY E. SHIPLEY, JOSEPH A. PARKER, HAROLD  
 P. TOTTER.  
 8:00-12:00. *Hand Surgery* Operative Clinic  
 Selected Cases. JOSEPH H. BOYER.

ORTHOPAEDIC HOSPITAL, LOS ANGELES

Monday

8:00-11:00. *Orthopedic Surgery* Operative Clinic Spinal  
 Fusion for Scoliosis. JOSEPH CHARLES RISSE.

Wednesday

8:00-10:00. *Orthopedic Surgery* Operative Clinic Fascial  
 Transplants. CHARLES LOWMAN

Thursday Morning

10:00-12:00. *Orthopedic Surgery* Nonoperative Clinic  
 Surgical Conference. HAROLD E. CROWE.

Every Afternoon

*Orthopedic Surgery* Nonoperative Clinic.

PHYSICIANS AND SURGEONS HOSPITAL  
 GLENDALE

Days not yet decided

8:30-12:00 *Gynecology* Operative Clinic. Vaginal Plastic  
 Procedures. HAROLD A. MARSHALL.  
 8:30-12:00. *General Surgery* Operative Clinic. Two-  
 Team Abdominoperineal Resection of Rectum. ELMER  
 BELT.  
 8:30-12:00. *General Surgery* Operative Clinic. Resection  
 Carcinoma of Esophagus or Transthoracic Vagotomy  
 HAROLD LINCOLN THOMPSON  
*Orthopedic Surgery* Nonoperative Clinic  
 Knee Surgery. HUGH T. JONES.

*Orthopedic Surgery* Nonoperative Clinic.

Surgical Treatment of Fractures—motion pictures.  
 CHARLES W. GILFILLAN  
*Orthopedic Surgery* Nonoperative Clinic  
 Internal Fixation of Fractures. JOSEPH WOLF  
*Orthopedic Surgery* Nonoperative Clinic  
 Backache. JOHN R. BLACK.  
*Gynecology* Nonoperative Clinic  
 General Vaginal Prolapse. HAROLD K. MARSHALL,  
 DANSON TARR, MATT STURDEVANT

QUEEN OF ANGELS HOSPITAL, LOS ANGELES

Tuesday

8:00-11:00. *Otorhinolaryngology and Ophthalmology* Oper-  
 ative Clinics  
 Frenotomy Operation. HOWARD P. HOUDE.  
 Laryngectomy. ALDEN MILLER.  
 Nasoplasty Operation. JOSEPH GAYNOR.  
 Strabismus. Demonstration of the O'Connor Clinch Oper-  
 ation and Recession of the Inferior Oblique Muscle.  
 ALFRED ROBBINS  
 Cataract Extraction by the Castroviejo Suction Tech-  
 nique. MAURICE NUGENT  
 Combined Extraction. STEPHEN POPOVICH  
 Glaucoma. Decompression Operation. IRVING SCHUMAN  
 10:00-12:00. *Orthopedic Surgery* Operative Clinic:  
 Sympathectomy for Peripheral Vascular Disease. EDWIN  
 PLIXTON  
 11:30-1:00. *Otorhinolaryngology and Ophthalmology* Non-  
 operative Clinics  
 Illustrated Lecture on Acute Obstructive Laryngitis.  
 ALDEN MILLER  
 Deafness in Children Treated by Radiation. LAWRENCE  
 GUNDM.  
 Sclerotic Mastoid and its Roentgen Interpretation.  
 GILBERT OWEN  
 The Treatment of Corneal Scars by Beta Irradiation.  
 WILLIAM H. BOYD  
 The Tucky Corneal Lens. MAURICE NUGENT  
 Complication Following Cataract Extractions. IRVING  
 SCHUMAN  
 The Scleral Shortening Operation for Detachment of the  
 Retina. (Motion picture in color) W. E. BORLEY  
 Essential Hypertension and its Ophthalmoscopic Inter-  
 pretations. STEPHEN POPOVICH.

Wednesday

8:00-11:00. *Obstetrics and Gynecology* Operative Clinics  
 Total Hysterectomy. FRANK F. SCHAEZ.  
 Vaginal Hysterectomy. SAMUEL MARTINS  
 Vaginal Plastic Operation for Correction Cystocele  
 Rectocele and Laceration of Pelvic Floor. H. NIEBER  
 GALL.  
 Vaginal Plastic Operation for Correction of Stress In-  
 continence of Urine (Kennedy Procedure). DANIEL  
 MISHELL.  
 8:00-11:00. *General Surgery* Operative Clinics  
 Diaphragmatic Hernia. Thoracic Approach. J. N.  
 O'NEILL.  
 Gall Bladder. ROBERT STEWART  
 8:00-11:00. *Orthopedic Surgery* Operative Clinics  
 Herniated Disc. CHRISTOPHER MASON.  
 Pinning of Fracture of Neck of Femur. FRED ILFELD.  
 Arthroscopy for Benign Tumor. JOSEPH PELUSO.  
 11:30-1:00. *Obstetrics and Gynecology* Nonoperative  
 Clinics.  
 Pregnancy Following Conservative Treatment for Pelvic  
 Endometriosis. DANIEL MISHELL and UMBERT E.  
 ANZ.

Early Rupture of the Uterus Before the Onset of Labor  
A. M. MCCARTHY and C. V. VOX DER AHE.  
Low Spinal Anesthesia in Obstetrics. A Report of 2,000  
cases. FRANK F. SCHADE and WILLIAM CALDWELL.

#### Thursday

- 8:00-10:00. *General Surgery* Operative Clinics  
Thyroidectomy WALTER SULLIVAN and THOMAS D.  
CARLSON.  
Radical Mastectomy DONALD E. ROSE.  
Abdominal Perineal Resection of Rectum. WILLIAM  
DANIEL.  
Colon Surgery JAMES L. NEELER and D. A. GARZANTUA.  
8:00-10:00. *Orthopedic Surgery* Operative Clinics.  
Intermedullary Pinning of Fracture. Anterior Approach  
to Elbow Joint. HOMER PERRASANT.  
Osteotomy and Fixation of Non-Union of Neck of Femur  
by a New Reverse Nail. GALE HUNT.  
Subcutaneous Fasciotomy for Dupuytren's Traction.  
J. VERNON LOCK.  
10-12:00. *Orthopedic Surgery* Nonoperative Clinics.  
End Results of Intermedullary Pinning of Fracture.  
ALFRED GALLANT.  
Slipped Upper Femoral Epiphysis. GALE HUNT.  
Subcutaneous Fasciotomy (Motion picture) J. VERNON  
LOCK.  
Reconstruction of Elbow J. Juries. HOMER PERRASANT.

#### Friday

- 8:00-10:00. *General Surgery* Operative Clinics.  
Tractotomy for Tic Douloureux. RUPERT B. RABEY.  
Gall Bladder Surgery WALTER HOLLERAN.  
Carcinoma of Bladder. FRED BENOISTE.  
Partial Gastrectomy JAMES F. REGAN.  
Resection Carcinoma of Esophagus. FRANK S. DOLLEY  
and LYMAN BREWER.  
Retropubic Prostatectomy MORTON M. MAYERS.  
Thyroidectomy DANIEL FORTMAN.  
10-12:00. *General Surgery* Nonoperative Clinics.  
Radical Mastectomy (Motion picture in sound and  
color) DONALD E. ROSE.  
Mastopexy (Motion picture in color) JOSEPH GAYNES.  
Sympathectomy (Motion picture) RUPERT B. RABEY.  
Diabetes Mellitus Complicating Surgery. KENNEDY  
SMITH.

#### ST JOHN'S HOSPITAL, SANTA MONICA

#### Monday

- 8:00-10:00. *General Surgery* Operative Clinics: Surgery of  
the Gallbladder. RODRIGUEZ M. NEALE.  
8:00-10:00. *Obstetrics and Gynecology* Operative Clinics:  
Cesarean Section (Bicornuate Uterus). B. H. W. THOM.  
10-12:00. *General Surgery* Operative Clinics: Surgery  
of the Colon. G. ARNOLD STEVENS.  
1-3:00-1:00. *Orthopedic Surgery* Operative Clinics: Lam-  
inectomy with Spinal Fusion. DANIEL H. LEVINTHAL.

#### Tuesday

- 8:00-10:00. *General Surgery* Operative Clinics: Thyroid-  
ectomy. G. ARNOLD STEVENS.  
8:00-10:00. *Obstetrics and Gynecology* Operative Clinics:  
Anterior and Posterior Colpopereoneoplasty and Kelly  
Stitch. JAMES C. DOTY and ALBERTUS C. MORTON.  
10-12:00. *General Surgery* Operative Clinics: Gastric  
Resection. MARCUS H. RABWIN and DAVID H. ROSEN-  
BLUM.  
10-12:00. *Orthopedic Surgery* Operative Clinics: Ar-  
throscopy of the Knee. DANIEL H. LEVINTHAL.

#### Wednesday

- 8:00-10:00. *General Surgery* Operative Clinics: Rad-  
ical Mastectomy. JOHN F. ROBERTS.  
8:00-10:00. *Genitourinary Surgery* Operative Clinics:  
Retro-public Prostatectomy. GILBERT J. THOMAS and  
FRED C. SCHLOSSBERGER.  
10:00-12:00. *General Surgery* Operative Clinics: Vaginal  
and Posterior Gastroenterostomy. FRANK I.  
BROWNE and HENRY J. LANGE.  
10:00-12:00. *Plastic Surgery* Operative Clinics: Re-  
plantation. J. J. PERRASANT.

#### Thursday

- 8:00-10:00. *General Surgery* Operative Clinics: Hemo-  
rhaphy (Tantalum Gauze and Tantalum Wire).  
MARCUS H. RABWIN and DAVID H. ROSENBLUM.  
8:00-10:00. *Obstetrics and Gynecology* Operative Clinics:  
Total Hysterectomy. B. H. W. THOM.  
10-12:00. *General Surgery* Operative Clinics: Mide-  
Hemorrhaphy. FRANK E. BROWN and HENRY  
J. LANGE.  
10-12:00. *General Surgery* Operative Clinics: Ex-  
tension of Common Duct. G. ARNOLD STEVENS.  
Daily Pathological, nonoperative clinic, Rapid Method  
Surgical Tissue Diagnosis. G. H. HUNTER.  
Daily Micro. Laboratory, nonoperative clinic, Path-  
graphic Akia. G. H. HUNTER.

#### ST JOSEPH HOSPITAL, BURBANK

#### Days not yet decided

*General Surgery* Operative Clinics: Selected cases

#### ST LUKE HOSPITAL, PASADENA

#### Days not yet decided

*Orthopedic Surgery* Nonoperative Clinics.  
*Genitourinary Surgery* Nonoperative Clinics.

#### ST VINCENT'S HOSPITAL, LOS ANGELES

#### Tuesday

- 9:00-10:00. *Obstetrics* Operative Clinics: Select  
cases. J. MACDONALD BROWN.  
9:00-10:00. *Ophthalmology* Operative Clinics: Select  
cases. A. RAY IRVING.  
9:00-10:00. *General Surgery* Operative Clinics: Thyroid-  
ectomy. WILLIAM P. KROGER.  
9:00-10:00. *General Surgery* Operative Clinics: Select  
cases. FRANK J. BRILLIN.  
9:00-10:00. *General Surgery* Operative Clinics: Select  
cases. FRANK E. BROWNE, HENRY J. LANGE.  
9:00-10:00. *General Surgery* Operative Clinics: Select  
cases. IAN MACDONALD, LEWIS W. GIBBS.  
10-12:00. *Tumor Surgery* Nonoperative Clinics: Ma-  
lignant Lesions of Colon. KENNEDY S. DAVIS.  
1-3:00. *General Surgery* Nonoperative Clinics: Sur-  
gery of Colon—motion pictures. WILLIAM H. DAVIS.  
10-12:00. *General Surgery* Nonoperative Clinics: Sur-  
gery of Esophagus—motion picture. HAROLD LUND.  
12:00-1:00. *General Surgery* Operative Clinics: Select  
cases. CONRAD J. BAUMGARTNER.  
1:00-2:00. *General Surgery* Operative Clinics: Colon  
Surgery. RALPH V. BRYCE.

#### Wednesday

- 9:00-12:00. *Orthopedic Surgery* Operative Clinics: Select  
cases. FLORENCE T. JONES, JOHN R. BLACK.

- 9:00-12:00. *Orthopedic Surgery* Operative Clinic Selected cases. FRANCIS A. McKEEVER
- 9:00-12:00. *Neurosurgery* Operative Clinic Selected cases. RUPERT B. RAMEY
- 9:00-12:00. *Neurosurgery* Operative Clinic Selected cases. C. HUNTER SKELDEN
- 9:00-12:00. *Otolaryngology* Operative Clinic Fenestration. HOWARD P. HOUSE
- 9:00-12:00. *Ophthalmology* Operative Clinic Selected cases. JOHN P. LORDAN
- 9:00-12:00. *Plastic Surgery* Operative Clinic Selected cases. ARTHUR E. SMITH
- 10:00-12:00. *Tumor Surgery* Nonoperative Clinic Thyroid Malignancy. HENRY J. LANGRISH
- 10:30-12:00. *Tumor Surgery* Nonoperative Clinic Struma Lymphomatosa and Fibrosis. ROBERT C. SURRIDGE
- 11:00-12:00. *General Surgery* Nonoperative Clinic Obstructive Corrosive Gastritis. LOUIS C. BENNETT

## Thursday

- 9:00-11:00. *General Surgery* Operative Clinic Selected cases. E. VINCENT ARKEY
- 9:00-11:00. *Otolaryngology* Operative Clinic Selected cases. JOSEPH B. STEVENS
- 9:00-11:00. *Gynecology* Operative Clinic Selected cases. BERNARD J. HANLEY JOHN C. McDERMOTT
- 9:00-11:00. *Proctology* Operative Clinic Surgery of Colon. WILLIAM H. DANIEL
- 9:00-11:00. *General Surgery* Operative Clinic Vagus Neurectomy. EDWARD C. PALLETTE
- 9:00-11:00. *Ophthalmology* Operative Clinic Selected cases. CLARENCE H. ALBAUGH
- 10:00-11:00. *Orthopedic Surgery* Nonoperative Clinic Surgery of Hand. FRANK J. BRESLIN
- 10:30-11:00. *Orthopedic Surgery* Nonoperative Clinic Surgery of Knee Joint. HUGH T. JONES, JOHN R. BLACK
- 11:00-12:00. *Neurosurgery* Nonoperative Clinic Surgical Management of Intracranial Aneurysms—motion picture and lantern slide illustrations.
- 11:00-12:00. *General Surgery* Operative Clinic Selected cases. E. ERIC LARSON

## Friday

- 9:00-11:00. *General Surgery* Operative Clinic Selected cases. LOUIS C. BENNETT
- 9:00-11:00. *Plastic Surgery* Operative Clinic Selected cases. ARTHUR E. SMITH
- 9:00-11:00. *General Surgery* Operative Clinic Selected cases. FRANCIS E. BROWNE, HENRY J. LANGRISH
- 9:00-11:00. *General Surgery* Operative Clinic Selected cases. WILLIAM P. KROGER, ROBERT C. SURRIDGE
- 9:00-11:00. *Genitourinary Surgery* Operative Clinic Selected cases. ALBERT J. SCHOLL, EDMUND CROWLEY
- 10:00-11:00. *General Surgery* Nonoperative Clinic Trans-thoracic Vagus Neurectomy. E. C. PALLETTE
- 10:30-11:00. *General Surgery* Nonoperative Clinic Surgery of Spleen. RALPH V. BYRNE
- 11:00-12:00. *General Surgery* Nonoperative Clinic Carcinoma of Tongue, or Primary Mandibular Tumors. IAN MACDONALD, LEWIS W. GUTHRIE
- 11:00-12:00. *General Surgery* Operative Clinic Selected cases. DAVID A. SCHMIDT

SANTA FE COAST LINES HOSPITAL,  
LOS ANGELES

## Monday

- 9:00-11:00. *Genitourinary Surgery* Operative Clinic Retroperitoneal Prostatectomy. V. J. GALLAGHER

- 9:00-10:00. *Neurosurgery* Nonoperative Clinic The Herniated Intervertebral Disc, Discussion of Multiple Herniations. HENRY M. CONZO
- 9:00-10:00. *Otolaryngology* Nonoperative Clinic Allergy of the Nose and Paranasal Sinuses. GORDON J. MCCURDY

## THE SANTA MONICA HOSPITAL

## Thursday

- 9:00-11:00. *General Surgery* Nonoperative Clinics Traumatic Surgery. CHARLES A. LINDQUIST  
A New Method for the Movement of Fluids in the Extremities. J. P. SAMPSON and FREDERICK G. KIRBY
- Orthopedic Surgery* Operative Clinic  
Reconstructive Orthoplasty of Congenitally Dislocated Hip. WILLIAM H. WRIGHT  
Demonstration Pre-ambulatory Diagram of Dislocated Hips. JOSEPH C. RISSER  
Contrast Orthogram of Dislocated Hips. RALPH MILLER

U. S. ARMY McCORMACK GENERAL  
HOSPITAL, PASADENA

## Friday

- 9:00-9:30. *Genitourinary Surgery* Nonoperative Clinic Amicrobial Urinary Infections. LYMAN STEWART
- 9:30-10:00. *General Surgery* Nonoperative Clinic The Treatment of Regional Ileitis. GORDON K. SMITH
- 10:00-10:30. *Plastic Surgery* Nonoperative Clinic Treatment of Facial Injuries. MONROE K. ROCH
- 10:30-11:00. *Orthopedic Surgery* Nonoperative Clinic Treatment of Fracture of Forearm. VERNOV J. LUCK
- 11:00-11:30. *General Surgery* Nonoperative Clinic Hernia Repair Using Cooper's Ligament. LAWRENCE C. BALL

## U. S. NAVAL HOSPITAL, LONG BEACH

## Day not yet decided

- 9:00-12:00. *General Surgery* Operative Clinics. Gastrectomy. E. ERIC LARSON Cholecystectomy. L. L. BEAN
- 9:00-12:00. *Genitourinary Surgery* Operative Clinics Retro Public Prostatectomy. CARL F. RUSCHLE  
Varicocelectomy. MILLO ELLIS and L. A. NEWTON
- 9:00-12:00. *Orthopedic Surgery* Operative Clinic Operation for Recurrent Dislocation of the Shoulder. R. R. MYERS and JOHN M. ROWE
- 9:00-12:00. *Otolaryngology* Operative Clinic Rhinoplasty Using Cancellous Bone. E. KING, ROBERT C. BOYDEN F. L. ASHLEY
- 9:00-12:00. *Neurosurgery* Nonoperative Clinic Cerebral Aneurysms. ROBERT H. PUDENZ, CHAS. H. SKELDON, ARTHUR L. SCHULTZ
- 9:00-12:00. *Thoracic Surgery* Nonoperative Clinic Carcinoma of the Lung. BERT H. COTTON and V. C. STRATTON
- 12:00-4:00. *General Surgery* Nonoperative Clinics Ward Rounds, Follow up on Vagus Resection and Gastric Resection. E. ERIC LARSON, RALPH V. BYRNE, WILLIAM E. DELBETH, CALVIN A. LAUER, L. L. BEAN
- 1:00-4:00. *Genitourinary Surgery* Nonoperative Clinic Post-operative Results from High Varicocelectomy. CARL F. RUSCHLE, MILLO ELLIS, and L. A. NEWTON
- 1:00-4:00. *Otolaryngology* Nonoperative Clinic Motion Pictures. Nasal Bone Graft and Post-operative Results. E. KING, ROBERT C. BOYDEN, KENNETH C. BRANDENBERG
- 12:00-4:00. *Neurosurgery* Operative Clinic Trans-frontal Craniotomy or Cervical Disc. C. HUNTER SKELDEN, ROBERT H. PUDENZ, ARTHUR L. SCHULTZ

100-400. *Thoracic Surgery* Operative Clinic:  
Pneumectomy. **BERT H. CORTON** and **V. C. STRATTON**  
100-400. *Orthopedic Surgery* Nonoperative Clinic:  
Ward Rounds, Post Operative Care of the Orthopedic  
Patient. **JOHN M. ROWE** and **R. R. ALTHEA**, J. G.  
MARKING.

U. S. VETERANS ADMINISTRATION  
BIRMINGHAM GENERAL HOSPITAL, VAN NUYS

Wednesday

9:00-10:00. *Genitourinary Surgery* Nonoperative Clinics  
Results of Uretero-intestinal Implantation and Cystec-  
tomy for Carcinoma of Bladder. **DONALD C. MAL-  
COLM**.

*Thoracic Surgery* Operative Clinic.

Pulmonary Decortication. **JOSEPH A. WEIDENBERG**.

*General Surgery* Operative Clinics

Surgical Problems of the Paraplegic. **ERNEST BORN**.

Trans Abdominal V.otomy and Gastrojejunostomy  
**FRANKLIN B. WILKINSON**.

Thoracolumbar Sympathectomy by Intercostal Ap-  
proach. **THEODORE B. MARSHALL**.

*Neurosurgery* Operative Clinic Cervical Laminectomy for  
Dissecting Disease. **JOHN D. FRIEDMAN**.

*Otolaryngology* Operative Clinics Reconstructive Rhin-  
oplasty for Nasal Obstruction. **SAMUEL KAPLAN**.

Endaural Radical Mastoidectomy. **SAMUEL KAPLAN**.

100-100. *Orthopedic Surgery* Nonoperative Clinics  
Care of Traumatic Injuries of the Hand. **JOHN H. ALDER**  
and **JOSEPH H. BOYER**.

Treatment of Bone and Joint T.B. with Streptomycin.  
**JOHN H. ALDER**.

U. S. VETERANS ADMINISTRATION CENTER,  
WADSWORTH GENERAL HOSPITAL, SAWTELLE

9:00-10:00. *General Surgery* Nonoperative Clinics

Symposia. Tri-ethylammonium in Evaluation of  
Peripheral Vascular Disease. **C. H. MCINTYRE**.

Results of Histidine and Ascorbic Acid Treatment of  
Peripheral Vascular Disease. **RUDOLPH WITTMANN** and  
**MILTO RITZOLD**.

A New Method for the Movement of Fluids in the Ex-  
tremities. **F. G. KIRBY** and **J. P. SAMPSON** (Santa  
Monica Hospital).

*Orthopedic Surgery* Nonoperative Clinic

Symposium Amputations in Peripheral Vascular Dis-  
ease. **ROBERT MAZET**.

*General Surgery* Operative Clinics

Lumbar Sympathectomy. **CHARLES S. KIRBY**.

*Anesthesia* Operative Clinic: Train Clinic. **CARLES Y.**

**MCCURRICK**, **EDMUND WARNOCK**, and **KYRT B. ROY**.

*Ophthalmology and Otolaryngology* Nonoperative  
9:00-9:30. Fundus Lesions with Pathological Section and  
Microphotographic Slides. **A. RAY LUTHER** and **CARLES**

**S. ALUMMA**.

9:30-10:00. Malignancies of Ear, Nose and Throat and

Case Presentations. **CLAUDE S. MICHON** and **STAFF**.

10:00-10:30. Penetration Operation for Ovarian Cancer and

Case Presentations. **CLAUDE S. MICHON** and **STAFF**.

WHITE MEMORIAL HOSPITAL, LOS ANGELES

Tuesday

9:00-10:00. *Genitourinary Surgery* Operative Clinic

Vesical Diverticulectomy and Urethrophasty for Urinary  
Incontinence. **ROGER W. BARBER**, **R. THOMAS**

**BERGMAN**.

9:00-10:00. *Orthopedic Surgery* Operative Clinic

Surgical Treatment of Coxa, Metatarsal Galls,  
Hammer Toe, and Bunions. **ALFRED J. VERNON** and  
**ASSOCIATES**.

10:00-11:00. *Genitourinary Surgery* Operative Clinic

Transurethral Prostatic Resections. **ROGER W. BARBER**,  
**R. THOMAS BERGMAN**.

11:00-12:00. *Genitourinary Surgery* Nonoperative Clinics

Motion Picture Film—Transurethral Prostatic Resec-  
tion. Lantern Slide Demonstration. Round table Dis-  
cussion. **ROGER W. BARBER**, Moderator.

Wednesday

9:00-10:00. *General Surgery* Operative Clinic

Total Excision of Parotid Gland with Preservation of  
Facial Nerve. **CLARENCE E. NELSON** and **STAFF**.

*Obstetrics and Gynecology* Operative Clinics

Vaginal Hysterectomy Low Cervical Cesarean Section  
**RALPH J. THOMPSON** and **STAFF**.

Thursday

9:00-10:00. *Proctology* Operative Clinics

Two-team Abdominal Perineal Resection for Carcinoma  
of the Rectum, Ano-rectal Surgery (Selected Cases)  
**MALCOLM R. HILL** and **ASSOCIATES**.

*Otolaryngology* Operative Clinics

Fenestration Rhinoplasty Endoscopic Clinic. **BROWN**  
**N. COLVER** and **ASSOCIATES**.

September, 1948

**SURGERY**  
**GYNECOLOGY AND OBSTETRICS**  
*Supplement*

**INTERNATIONAL ABSTRACTS**  
**OF SURGERY**

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## COLLECTIVE REVIEW

### THE EARLY TREATMENT, AND RESULTS THEREOF, OF INJURIES OF THE COLON AND RECTUM<sup>1</sup>

With 70 Additional Cases

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#### OPERATIVE TREATMENT OF WOUNDS OF THE RECTUM

It is in the treatment of rectal wounds that the greatest reduction in the mortality rate of wounds of the large intestine has occurred. In World War I the mortality rate was very high and wounds of the rectum were more grave than those of the colon. Today the reverse is true. In World War I the method of treatment was not the same as that of today. Proximal colostomy was used only in severe wounds. Most men did not recognize the value of wide drainage in extraperitoneal wounds. However some men clearly realized the great importance of wide retrorectal drainage and carried it out in their cases. Drummond and many others recognized that retroperitoneal infection was a very serious threat in these cases.

*Intraperitoneal wounds of the rectum.* With regard to these types of wounds, Drummond wrote "Intraperitoneal wounds of the rectum low down in the retrovesical pouch are most difficult to treat by suture on account of the depth of the narrow male pelvis, and I think in these cases Sir Cuthbert Wallace suggested obliteration of the rectovesical pouch by sutures with the addition of a colostomy, a plan well worth a trial or the introduction of a large tube into the anus to provide for very ample drainage. Again these intraperitoneal rectal wounds are frequently accompanied by much laceration of the lowest coils of the ileum

as it lies in the true pelvis and also by injury of the bladder and severe compound fracture of the pelvic bones. In six of the sixteen cases in this series the small bowel was perforated, and the bladder ruptured four times whilst the sacrum and pelvic bones were fractured in eight cases.

In extraperitoneal wounds of the rectum the only hope of success lies in very free local drainage carried out at the earliest possible moment. With a view to establishing efficient drainage I removed in two cases the uninjured coccyx in addition to free drainage of the wounds of entry and exit, and found by stripping up the bowel that one was able to expose the wound in the rectum and was thus enabled to drain and pack off the surrounding parts and prevent further tracking by retroperitoneal hemorrhage. Both patients succumbed from other complicating wounds, but I think in suitable cases the plan is a good one.

From a review of his reports of cases it was, strikingly the complete inadequacy of his supportive treatment that caused his failures. He did not transfuse blood or employ chemotherapy. By the end of the war proximal colostomy and retrorectal drainage had already assumed an important place in the treatment of rectal wounds. The results obtained in two other series are interesting. Wallace and Bowly in a series of 965 cases of abdominal wounds treated surgically had 21 patients with rectal wounds, with a mortality rate of 66 per cent. In their treatment drainage

<sup>1</sup>Continued from August issue.



TABLE XIII.—INTRAPERITONEAL WOUNDS OF THE RECTUM MORTALITY RATES AS REPORTED IN WORLD WAR II SERIES

Series	Patients		Mortality per cent
	No.	Deaths	
Morgan	5		40.0
Pearson and associates	8	1	12.5
Present series	6	4	66.7
Totals	9	7	37.0

wound or by making the wound extraperitoneal, with the use of generous drainage and defunctionalization of the wounded segment.

*Extraperitoneal wounds of the rectum* More has been written about extraperitoneal wounds of the rectum. It is in these wounds that primary treatment is most satisfactory. The mortality rate associated with such wounds is now the lowest of any wounds in any part of the large intestine about 6 per cent when proper treatment is carried out. In World War I these wounds were virtually lethal. The modern operative treatment of such wounds, the rationale of the different steps in the operative approach and the results thereof will be considered next.

The two most fundamental steps are performance of proximal colostomy and the establishment of drainage of the retrorectal spaces. The results obtained when these two steps have been used routinely are shown in Table XIV which is adapted from reports of American surgeons in Europe. These results are contrasted with results in Morgan's British series which he composed from data also from the European Theater.

Other British series in the literature are not broken up into intraperitoneal and extraperitoneal wounds. Ogilvie (28) cited 47 cases of rectal wounds in Africa in which the mortality rate was 36.1 per cent. From the Twenty First Army Group in Europe, Porritt cited 39 cases of rectal injury alone, with a mortality rate of 36 per cent, and 70 cases of rectal injury combined with injury to other abdominal organs, with a mortality rate of 50 per cent. In Ogilvie's and Porritt's series no detailed analysis of treatment was given. Ogilvie's policy was one of performance of colostomy for even suspected wounds of the rectum in all cases but routine institution of retrorectal drainage in extraperitoneal wounds was not so strongly emphasized as in the American armies of the European Theater of Operations. Porritt did not describe the policies carried out in the Twenty First Army Group.

TABLE XIV.—EXTRAPERITONEAL WOUNDS OF THE RECTUM MORTALITY RATE WITH AND WITHOUT ROUTINE USE OF COLOSTOMY AND RETRORECTAL DRAINAGE

Series	Patients	Deaths	Mortality Per cent
Colostomy and retrorectal drainage used routinely			
Jarvis, Byars, Platt	9	0*	0*
Bradford, Battle, Pasachoff	18		3.6
Leifman	23	2	8.6
Hurt	6		
Pearson, Tuby and Welch	55		6
Present series	7		14.3
Totals	120	7	5.8
Colostomy and retrorectal drainage not used routinely			
Morgan	22	0	0.0

\*This information received by personal communication.

In extraperitoneal wounds the excellent results procured by the routine use of colostomy and wide retrorectal drainage speak for the fundamental soundness of this method of treatment. The poorer results in Morgan's cases and in Ogilvie's, in which these methods were not so routinely used, suggest that it is unsound to compromise either of these two principles. Morgan analyzed his cases in which death ensued, and it is clear that when either colostomy or retrorectal drainage was not used or was attempted late the result was severe infection. Six of the 8 deaths in his series were caused by severe sepsis. Croce, Johnson and Wiper gave definitive treatment and observed this type of condition late. They came to the conclusion that both colostomy and retrorectal drainage are necessary to prevent sepsis and to obtain healing of the rectal wounds. Thus, we consider it conclusively proved that colostomy combined with wide retrorectal drainage gives excellent results, and that to omit either one is to court disaster.

Pelvic infection is the danger when either colostomy or wide drainage is omitted. This infection was clearly recognized in World War I. Drummond described it as being a most severe and often fatal infection. It is now recognized as the most serious complication of the extraperitoneal rectal wound. It can develop early and can be fulminating with death resulting within 24 hours, or it can develop late. Once the infection has taken a firm hold, it is apparently difficult to drain the process. The patient might die of chronic suppuration weeks after he had been wounded.

was not mentioned. These authors advised proximal colostomy only in the presence of very severe wounds of the rectum and when the suture line was thought to be poor. Fraser and Drummond reported 10 cases of rectal wounds in which the patients were treated surgically and the mortality rate was 70 per cent. In their series of extraperitoneal wounds the entrance wound was opened thoroughly and proximal colostomy was reserved for severe wounds. Intraperitoneal wounds were sutured only. It must be remembered that in World War I after the policy to operate on abdominal wounds was accepted, many surgeons operated alone, none had chemotherapy or the transfusion of blood available to them, and the value of gastric suction was not recognized. Many patients came in and were not operated upon because they were considered moribund.

The attitude of the United States Army at the end of World War I is summed up in the following, quoted from Lee in *The Medical Department of the United States Army in the World War*:

"The extraperitoneal injuries are best treated by careful debridement of the buttock or perineal wound, the dissection being carried upward and into the rectum. It may be necessary to open widely the lower segment of the bowel in order that complete dissection of the tract may be accomplished and that adequate drainage may be most effectively placed in the retroperitoneal tissues. Extensive lacerations of the lower segment may require a colostomy. Intraperitoneal injuries are treated by a median laparotomy with suture of the opening wherever it is possible to accomplish it. Drainage through the lower angle of the operative wound should always be practiced, rubber dam being the best material for the purpose. If a suture cannot be made, owing to the depth of the rectal wound in the pelvis, a colostomy should be performed.

"The mortality with wounds of the rectum is 45 to 50 per cent. Usually death is due to a rapidly advancing sepsis in the retroperitoneal tissues or to a severe spreading peritonitis."

In World War II the mortality rate associated with rectal wounds probably was reduced more dramatically than were mortality rates accompanying wounds of any other abdominal viscera. Whole blood and plasma became available, and usually were used most liberally by the Americans and British. Likewise, the sulfonamides, penicillin, or both were available in most cases. These adjuncts to treatment were of tremendous value, and enabled surgeons in this war to undertake and complete successfully operations which undoubtedly would have been failures in the earlier war.

We are convinced that a change in the operative treatment also was very important in the reduction of this particular mortality rate.

The change in the operative treatment of intraperitoneal wounds consisted of the change from only rare performance of proximal colostomy to routine use of it. Ogilvie (28) stressed the importance of proximal colostomy in all rectal wounds. It is difficult to determine how greatly this change in procedure influenced the mortality rate. In most series the mortality rates associated with extraperitoneal and intraperitoneal wounds of the rectum are not presented separately so that the respective mortality rates for each type of wound are not given. It can be said only that the mortality rate accompanying rectal wounds in general has been greatly reduced.

A few surgeons have, however, reported mortality rates associated with intraperitoneal wounds of the rectum as shown in Table XIII. On the basis of the small group of cases in this table, it appears that in intraperitoneal wounds the outlook is much poorer than in extraperitoneal wounds, in which the mortality rate is around 6 per cent, as will be shown later herein. This higher mortality rate associated with intraperitoneal wounds probably is due to the shock associated with fecal contamination of the peritoneal cavity. Probably also, in intraperitoneal wounds there are more associated intra-abdominal injuries such as damage to the small intestine and bladder.

In our 6 cases of intraperitoneal wounds of the rectum, multiple organs were injured in 4. All 4 patients died. In contrast, of our 17 patients with extraperitoneal rectal injuries only 5 had injury of multiple organs. Pearson and his associates had 8 patients with intraperitoneal rectal injury. Of these 8 patients, 3 had injury of multiple organs and 1 died; all 5 with no other organ injured lived.

Occasionally there occurs in these wounds the difficult situation in which it is not possible to close the rectal wound. Morgan cited 3 such cases; both patients died. We had no such patients. It would seem that every effort should be made to close off the open rectum from the peritoneal cavity. Wallace suggested obliteration of the rectovesical pouch with sutures in wounds situated very low. The pelvic peritoneum might be mobilized and sutured above the wound, so that the wound becomes extraperitoneal. If this were done, establishment of wide drainage from below would be compulsory. Moreover the pelvis should be drained through the anterior abdominal wall. Thus, we think such desperate situations should be handled along the general lines of closure of the

are passed up to or above the level of the perforation.

Bradford, Battle and Pasachoff had 28 cases of wounds of the extraperitoneal portion of the rectum with 1 death. They said

In extraperitoneal rectal wounds adequate drainage is most important and this may necessitate removal of the coccyx. Drainage through the gluteal muscles should be avoided where possible. In all rectal wounds whether intraperitoneal or extraperitoneal a proximal colostomy should be performed to prevent further soiling and to allow for healing of the injured part.

Laufman in 35 consecutive cases of battle injuries to the extraperitoneal part of the rectum, had 3 deaths, only 1 of which was due to the rectal wound. Except for the injuries of one patient first seen 6 days after wounding and in excellent condition these wounds were treated by colostomy complete débridement of the tract and adequate incision of the rectal portion of the endopelvic fascia (fascia propria) with suture of the rectal wall when the defect was large. Coccygectomy was reserved for the most part for those patients who had a damaged coccyx.

We had 17 patients with extraperitoneal wounds of the rectum one of them died. The condition of the patient we lost was so poor that all we could do was to perform proximal colostomy and establish some degree of drainage from the rectal wound to the outside. We were unable to do any débridement of multiple fractures the patient later died of gas gangrene in these wounds.

We treated our patients by proximal colostomy and wide drainage of the rectal wound and the retrorectal tissue spaces never omitting either step. If adequate exposure or drainage was interfered with by the coccyx, we performed coccygectomy. In some cases the wound in the rectum was sutured in others, it was left open.

The site of colostomy should be in the left inguinal region and the sigmoid colon should be utilized. If there is severe damage of the rectum and if the sigmoid colon might be needed later on for repair or reconstruction of the rectum, the transverse colon should be utilized for colostomy. The same is true if there is much swelling of the mesosigmoid from gas or hemorrhage which might threaten obstruction or impairment of the blood supply. If the colon has been exteriorized proximal to the rectum for a more proximal wound in the colon this one colostomy is sufficient so long as the fecal stream is diverted from the rectum. Hurt declared

Communication with surgeons in Base Hospitals has revealed that loop colostomy for rectal

injuries has failed in many instances to completely divert the fecal current. Consequently, patients with rectal injuries have arrived with fecally contaminated buttock wounds, and the rectum filled with feces.

The loop probably should be completely divided for rectal wounds of severity when complete diversion of the fecal current from the rectal wound is particularly wanted. The complete division defunctions the distal segment better than does the partially divided loop.

Coccygectomy is certainly not necessary in all cases. We and many others have drained extraperitoneal wounds successfully without it. The indications for its use in the early treatment of rectal wounds are not clear to us as yet. We did not have the opportunity of following our patients long enough to determine whether or not complications arose by our not using it. We did coccygectomy in 5 of our 17 cases of extraperitoneal rectal wounds. Coccygectomy was employed when ever exposure was interfered with by the coccyx in the establishment of drainage or when the coccyx was injured. Our drainage probably was inadequate in one case in which we received a report that coccygectomy had been performed at a hospital in the rear. From those who carried out definitive treatment probably will come the answer as to when coccygectomy is necessary. There is little written about it. Hurt wrote Colcock has reported that osteomyelitis of the sacrum has been a frequent complication of coccygectomy in those with rectal wounds. Croce and associates, who carried out definitive treatment, think coccygectomy should be used in all wounds of the extraperitoneal portion of the rectum. Roettig Glasser and Barney rendered definitive treatment to 9 patients with rectal wounds produced by missiles perforating the sacrum or sacrum and coccyx. Osteomyelitis developed in most of these patients and was a problem. Excision of the coccyx by Roettig and associates was an important step in the surgical treatment of these patients in order to obtain exposure of the rectum. These cases of Roettig and associates bring up the question of closure of the rectal perforation.

All writers agree that intraperitoneal rectal wounds should be closed in all cases when this is possible. However concerning the closure of extraperitoneal wounds, there is still disagreement. In regard to extraperitoneal wounds, Jarvis and associates wrote No attempt has been made to suture lacerations of the rectum since early experience demonstrated that these suture lines do not hold. In fact, additional rectal wall may be sacrificed by its inclusion in the suture. Adequate

An example of such an infection is summarized below with a description of the important anatomic points with which we are concerned in extraperitoneal rectal wounds.

The rectum, the terminus of the large bowel, is arbitrarily said to begin at the level of the third sacral vertebra and end in the anal canal. Its average length is 15 cm. The lateral and anterior surfaces of the proximal portion, 5 cm. in the male, 7 cm. in the female, are invested with peritoneum. The posterior surface of this proximal portion is retroperitoneal, the distal portion is infraperitoneal. The rectum ending below at the level of the internal sphincter to become the anal canal is approximately 10 cm. long and is circumscribed by the external sphincter. The internal structure of the pelvic floor through which the rectum passes, may be likened to a trough, the sides of which are formed by the levators ani and coccygei flat, elongate muscles originating from the internal surfaces of the pelvis on either side, from the pubic tubercle in front to the coccyx behind, to join in median raphe below. The triangular anterior wall is formed by the urogenital triangle, while the triangular posterior wall is formed by the sacrum and coccyx. Through this troughlike space descend the rectum posteriorly and the urogenital tract anteriorly. Over this troughlike space and its sacra the peritoneum is loosely draped as a cover. Actually, this space is more potential than real, since it is filled with cellular areolar tissue. This space is, therefore, bounded laterally by the levators, inferiorly by their raphe, anteriorly by the urogenital triangle posteriorly by the sacrum and coccyx, and superiorly by the peritoneum, and will be referred to as the infraperitoneal space. When this space is distended by pus or blood, its expansion is found to be definitely limited in certain directions, relatively unlimited in others. Rigid fascial planes prevent extension in any direction except superiorly. Laterally these fascial planes are formed by the medial investment of the levators, the superior levator fasciae. These layers join inferiorly over the raphe and become continuous at the rectal and urogenital outlet with a similar layer of fascia loosely investing these viscera, the endopelvic fascia. Anteriorly the superior levator fasciae fuse with the deep layers of the urogenital triangle and posteriorly with the perineal layer of the sacrococcygeal fascia. Expansion of the infraperitoneal space is, therefore, limited inferiorly laterally anteriorly and posteriorly by fascial planes, but is relatively unimpeded superiorly by the loose peritoneal roof. Even thus, however, rather firmly directed laterally along the line of origin of the levators, is the so-called "hitch line" here levator fasciae fuses with the bifurcate fasciae below. Since the peritoneum is most loosely attached over the sacral promontory on either side of the rectum, it is here that the infraperitoneal space readily communicates with the retroperitoneal space. When the infraperitoneal space becomes distended with pus or blood, it, therefore, spills through this escape route into the retroperitoneal space. This has been demonstrated experimentally in the cadaver by the serial roentgenologic studies of progressive injection of sodium iodide solution into the infraperitoneal space. It is also well illustrated in one of the cases presented below. [The case they presented involved a soldier with an extraperitoneal wound which was not recognized early and in which drainage or colostomy was not employed until weeks after he had been wounded. He died about 4 months after wounding, of hemorrhage.] A topos revealed marked emaciation. The peritoneal floor of the pelvis cavity had been raised by the underlying necrotizing infection of the infraperitoneal space. This infection was not only posterior to the rectum, but had extended anteriorly about

the bladder. It communicated with the abscess underlying the left gluteal muscles through the bullet tract in the left levator muscle. There was perforation of the rectum in its posterior wall about 5 cm. above the anal orifice. The bullet lay imbedded in a crumbled mass of cancellous bone of the first and second sacral vertebrae near the sacro-lumbar joint just above the peritoneal reflexion. Thence, the fecal contents had extended retroperitoneally to the right iliac fossa where it continued to burrow upward along the posterior lateral wall of the ascending colon almost to the liver. About midway in the ascending colon, secondary ileocolic communication had become established with the retroperitoneal space (7).

The detailed treatment as carried out by different men will be presented. It is to the British that we owe this fundamental contribution to rectal surgery. As we have shown it was they in World War I who were stressing the importance of colostomy and drainage. It was the British in Africa under Ogilvie's direction who stressed colostomy and drainage, and showed the excellent results achieved by their use.

Ogilvie (18) stated: "All injuries of the rectum, however trivial, require a proximal colostomy. In most extraperitoneal injuries the retroperitoneal space should be drained either through the posterior wound or in the midline after the coccyx is removed. The anal sphincter must never be divided, but a large tube should be stitched into the anus."

Hurt wrote

"The initial surgery of extraperitoneal perforations of the rectum consisted of thorough débridement of the wound tract, suture of perforations, and sigmoid colostomy. In addition, resection of the coccyx and incision of the fascia propria were done to insure adequate drainage of the retroperitoneal, posterior and pararectal spaces. All sigmoid colostomies were of the loop type. It is the feeling of most of our surgeons that adequate drainage can be ensured through a curved incision inferior to the coccyx. Incision of the fascia propria and opening of the posterior and pararectal spaces by blunt dissection.

Jarvis, Myers, and Platt wrote

"The blunt dissection of the rectum from its loose sacral attachments is not considered complete until the sacral promontory is felt beneath the dissecting finger. We have preferred a hockey stick incision with its vertical arm on the side of greatest involvement. Since Colcock has reported osteomyelitis and pain on pressure as late complications from resection of the coccyx, we have avoided it except in 1 patient whose distal sacral segment and coccyx were fractured by the passage of the missile. After division of the fascia propria and blunt dissection of the rectum away from its areolar attachments to sacrum, soft rubber drains

are passed up to or above the level of the perforation

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Coccygectomy is certainly not necessary in all cases. We and many others have drained extraperitoneal wounds successfully without it. The indications for its use in the early treatment of rectal wounds are not clear to us as yet. We did not have the opportunity of following our patients long enough to determine whether or not complications arose by our not using it. We did coccygectomy in 5 of our 17 cases of extraperitoneal rectal wounds. Coccygectomy was employed when ever exposure was interfered with by the coccyx in the establishment of drainage or when the coccyx was injured. Our drainage probably was in adequate in one case in which we received a report that coccygectomy had been performed at a hospital in the rear. From those who carried out definitive treatment probably will come the answer as to when coccygectomy is necessary. There is little written about it. Hurt wrote Colcock has reported that osteomyelitis of the sacrum has been a frequent complication of coccygectomy in those with rectal wounds. Croce and associates, who carried out definitive treatment think coccygectomy should be used in all wounds of the extraperitoneal portion of the rectum. Roettig Glasser and Barney rendered definitive treatment to 9 patients with rectal wounds produced by missiles perforating the sacrum, or sacrum and coccyx. Osteomyelitis developed in most of these patients, and was a problem. Excision of the coccyx by Roettig and associates was an important step in the surgical treatment of these patients in order to obtain exposure of the rectum. These cases of Roettig and associates bring up the question of closure of the rectal perforation.

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drainage of the pararectal fascial spaces is secured, following which the rectal wall heals itself." Morgan said. A wound of the extraperitoneal portion of the rectum should not be sutured. He gave no reasons for this idea. The other men reporting large series from World War II either have employed suture or have not mentioned it. We sutured the extraperitoneal rectal wounds in many cases, but do not know the fate of our sutured wounds.

Two important facts stand out. First, many wounds in the extraperitoneal portion of the rectum do not heal spontaneously even after the performance of proximal colostomy and institution of retrorectal drainage. Chronic fistulas develop. Croce and associates said. Such fistulae, once well established, rarely heal spontaneously and require excision or at least closure on the internal orifice in the bowel wall. In the majority of the 9 cases of transsacral perforation of the rectum reported by Roetting and his associates the wounds did not heal spontaneously. In some of these, infection of the bone prevented healing. Also, there was a marked tendency for the rectal mucosa to evert and proliferate in front of the sacrum and along the sinus tract.

Second, in some cases, the suture lines do hold in extraperitoneal wounds of the rectum, without the formation of a fistula. Croce and his associates cited such cases, and believed that all extraperitoneal wounds should be sutured primarily. It seems most reasonable therefore, to suture these wounds in the rectum at the first operation to prevent the formation of fistulas which might delay the healing of wounds, increase morbidity and necessitate extra operations.

*Complications of wounds of the rectum.* The chief complications of wounds of the rectum are peritonitis and retrorectal infection, as already considered herein. Fistulas between rectum and skin or rectum and bladder are rather common. Osteomyelitis of the sacrum, coccyx, and other fractured pelvic bones occurs. Hemorrhage can be severe. Usually it is associated with those patients who have not been properly treated and have severe infection. Although injury to the bladder is not a complication, but an accompanying injury it is one which if overlooked can be most serious. This possibility always should be kept in mind because it is well known that it is often missed. It was the only known injury to an important viscus which we overlooked at laparotomy in our series of large intestinal wounds, and it resulted in a fatality. It is possible for a damaged although not perforated bladder to break down later. If a damaged bladder ruptures into the

peritoneal cavity the prognosis is grave if it ruptures into the rectum, a rectovesical fistula is established. This latter condition responds well to suprapubic cystostomy combined with the usual treatment of the rectal wound.

#### CASES IN THE PRESENT SERIES CONSIDERED ACCORDING TO ANATOMIC REGION OF INJURY TO THE LARGE BOWEL

The exact site at which the large bowel is injured plays such an important part in the type of operation to be employed and in the results to be expected that the cases have been arranged in groups according to the anatomic sequence of the lesions. The entire series constitutes a total of 70 cases, in which there were 19 deaths. Two of the deaths are classed as nonoperative since the patients never recovered from shock sufficiently to make it possible for them to undergo a surgical procedure. The 17 postoperative deaths produced a postoperative mortality rate of 25 per cent. In Table XV is shown our over-all mortality rate (27.1 per cent) associated with injuries of the large intestine, both intraperitoneal and extraperitoneal.

*Injuries of the cecum.* Three patients had injuries to the cecum alone none died. One patient had injuries to the cecum and small intestine which were not fatal. There were 3 other cases, not included in this group in which there was injury to the cecum, which was distinctly secondary to the major injury of another part of the colon. These 3 cases are included in the cases, respectively of injury to the ascending, descending, and sigmoid colon.

Two (Cases 2 and 4) of the 4 cases included in this section involved simple contusion without perforation, for which nothing was done. It has been our experience that severe contusions of the colon caused by high velocity missiles are potentially dangerous, and that ischemia and, later perforation may result. The consequence of such an event might be peritonitis or retroperitoneal cellulitis and the formation of abscess. Accordingly contusions of the bowel are included in these figures because in other cases expectant treatment was instituted. The inability to predict what will happen to a contused portion of large bowel and the dangers of subsequent ulceration make it safer to exteriorize the involved portion of the cecum. This was true particularly in Case 2.

In the other 2 cases (1 and 3) the cecum was frankly perforated and the holes were closed. One patient was treated by exteriorization, and the exteriorized portion opened spontaneously on the second postoperative day to form a cecal stoma. In the other case the cecum was not exteriorized,

although exteriorization would have been safer. The surgeon chose to exclude the two extraperitoneal holes from the general peritoneal cavity after he had closed the openings, and he drained the retroperitoneal space through a separate stab wound. The patient was observed for 17 days before evacuation and neither infection nor fecal fistula developed.

The size and the location of the cecum which lies more or less protected by the concavity of the ilium probably account for the low incidence of cecal injuries. They also explain why 50 per cent of injuries to the cecum were associated with compound fractures of the ilium. All of the 4 patients did well which might have been expected for in none was there extensive spilling of the fecal contents or spreading peritonitis. The lack of any uniformity in treatment plus the absence of complications, should not imply that the cecum can be treated with impunity for we cannot draw sound conclusions from observations based on a group this small.

It is our feeling that the best plan of treatment involves two features. The first is exteriorization of the damaged portion and the second is drainage of its retroperitoneal bed if that area is injured. It is perfectly safe and desirable to suture the holes before exteriorization and to leave them unopened in the hope that cecostomy can be avoided. The cecum is brought out through a McBurney incision of generous size and the wall of the cecum is tacked to the peritoneum at a safe distance proximal to the sutured holes. When possible no sutures should be used so as to minimize leakage from the sutured cecum into the peritoneal cavity. Iodoform gauze or vaseline packing is then placed so as to encircle the base of the protruding cecum, and this helps to seal off the peritoneal cavity and to keep the wound open.

Tube cecostomy has been employed with success in some of these wounds of the cecum. Hurt treated 3 patients who had single perforations in the right part of the colon or in the cecum by making a stab incision in the abdominal wall. He then inserted a tube into the colon wound and brought the tube with a 2 cm rim of adjacent colon wall out through the stab wound. This prevents any subsequent leakage into the peritoneal cavity. He proposed to close the colonic fistula at a secondary operation without entering the peritoneal cavity.

Jarvis and his associates wrote that they treated small perforations, particularly of the cecum and ascending part of the colon by suturing the colonic wall about a 1 inch (2.5 cm) rubber tube and securing it to the deep fascia by interrupted

TABLE XV—MORTALITY RATE, ACCORDING TO SITE OF INJURY IN 70 CASES OF WOUNDS OF LARGE INTESTINE PRESENT SERIES

Site	Cases	Deaths	
		Number	Per cent
Colon	43	14	32
Extraperitoneal rectum	17	1	5.9
Intraperitoneal rectum	6	4	66.7
Rectum (site undetermined)			
<b>Totals</b>	<b>70</b>	<b>19</b>	<b>27.1</b>

\*Two of the 19 deaths are nonoperative, as explained in the text of this paper.

sutures. When through-and-through wounds were present—that is a perforating wound of the anterior wall and the posterior wall of the cecum—they have sutured the posterior wound and converted the anterior wound into a cecal stoma by this tube method. They removed the cecostomy tube about 6 days postoperatively and drainage ceased a few days later. They used this tube technique successfully.

*Injuries of the ascending colon (Table XVI)* One other case (Case 43) is not included in this group because the injury to the ascending colon was distinctly secondary to the major injury in the sigmoid colon; this one case, therefore, is included in the cases of injury to the sigmoid flexure.

Wounds of the right portion of the colon present more problems than do wounds of any other section of the colon. This is because the ileum is the segment proximal to the right side of the colon. To deviate the fecal stream from the right side of the colon the ileum must be utilized which, of course, is not true when it is desired to divert the fecal stream elsewhere in the colon. To divert the fecal stream ileostomy or ileocolostomy is necessary.

Ileostomy has many objectionable features. After it has been performed there can be severe loss of fluid and nutrition. Ileal feces are most irritating to wounds and also to the normal skin. There is increased danger of breakdown of the wounds and dehiscence. Although we know of cases in which ileostomy was successfully employed in wounds of the right side of the colon we think ileostomy should not be used if it can be avoided.

Ileocolostomy however is a valuable procedure. When ileocolostomy has been performed loss of fluid and nutrition does not take place, there is no spillage of irritating contents on the abdominal wall and the formidable nursing problem disappears. An ileocolic anastomosis heals

TABLE XVI.—INJURIES TO THE TRANSVERSE COLON STRUCTURES INVOLVED IN 5 CASES  
PRESENT SERIES

Structure involved	Cases	Deaths
Transverse colon alone		
Transverse colon and jejunum		
Transverse colon, jejunum, and liver		
Transverse colon, stomach, and pancreas		
Transverse colon, jejunum, gall-bladder, stomach, and liver		
Total	5	

much better than does a colon-to-colon anastomosis. The indications for ileocolostomy will be discussed later.

Cecostomy is the most common method used to divert the fecal stream away from wounds of the ascending portion of the colon. When a cecal stoma is used thus as a proximal vent, it should be large if much diversion of the fecal stream is desired. If complete diversion of the fecal stream is desired, cecostomy will be inadequate.

Because there is this difficulty of diversion of the fecal current in wounds of the right portion of the colon there is a greater tendency toward more radical treatment and resection of such wounds. We feel, as we have already made clear herein, that resection should be avoided whenever possible. This decision was based in part on the 4 instances in which primary resection was performed in our group of 8 cases of wounds of the ascending colon. Primary resection is too shocking an operation in most cases of abdominal wounds. We think the simpler procedures are better if they suffice to handle the situation.

The procedure chosen often depends on the condition of the patient. It must not be forgotten that a patient who has been or is in shock after wounding is a poorer risk than one who has not been in shock. In abdominal wounds, the mortality rate varies directly with the degree of shock present. When the patient's general condition has been good before operation, and it appears he can tolerate the surgical treatment needed for all his wounds, then exteriorization in most cases is the method of choice. It should be done in almost all cases of large severe wounds. In these large wounds, we think that the danger of the wound breaking down is too great to justify suture.

When the patient's general condition is poor exteriorization with the extensive mobilization so often necessary to accomplish this, should not be done if a less shocking procedure can be safely sub-

stituted. Small and medium-sized wounds can be sutured. The suture should be accompanied by the added safety of cecostomy. The larger the wound sutured the more generous the cecostomy should be. In a small wound, if suture alone is the procedure chosen a drain should be used when cecostomy is omitted. A suture line is made safer by suture of the omentum or an epiploic appendix over the suture line.

Retroperitoneal wounds of patients who constitute a good risk probably should be exteriorized by mobilization of the colon, and then by bringing the wounded loop of bowel out onto the anterior abdominal wall. When such a procedure is used, the retroperitoneal spaces should be drained through a stab wound in the back to prevent the formation of a retrocolic abscess which often forms after such exteriorizations. When patients who are poor risks have retroperitoneal wounds, a generous tract should be established from the flank or back down to the wound in the colon. Dependent drainage should be instituted. The wound in the colon should be sutured if possible. Then the patient should be turned, the peritoneal cavity should be explored through an abdominal incision, and cecostomy should be performed. A mushroom catheter has been sutured into the wounded part of the colon and brought out through a stab wound posteriorly with success in some retroperitoneal wounds.

In most cases, resection should be considered only as a last resort. In the presence of very severe damage to a large segment of the ascending colon, resection of the damaged segment, with exteriorization of the open ends of the colon, is a wise procedure. Right colectomy might be necessary in a very extensive wound of the right part of the colon but should be avoided if possible. The procedure is too shocking in most cases. If the general condition of the patient is good and the surgeon is experienced, this operation might be the best way out of a bad situation. If right colectomy is performed ileotransversostomy should be performed at the same time, and the proximal open end of the transverse or ascending colon should be brought out through a stab wound to act as a safety valve for the anastomosis. We think that the ends of the ileum and colon should not be brought out as in spur ileocolostomy. This procedure has the bad features of an ileac stoma. A more detailed account of our own and others' experience with resection has been presented herein in the section on operative treatment of wounds of the rectum.

*Injuries of the hepatic flexure.* We had 3 patients with injuries of the hepatic flexure, and it is



interesting that in all 3 cases the kidney and liver were wounded in addition to the hepatic flexure. One of the 3 patients died. Wounds of the hepatic flexure should be exteriorized if the patient's condition permits it. This must be done when severe wounds are present, even if the patient's condition is poor. Mobilization is relatively simple in this part of the colon. If the wound in the colon is not severe and the patient's condition is poor then suture of the wound with performance of cecostomy is adequate. In case 13, the perforation in the exteriorized loop of bowel was sutured at the primary operation and remained closed.

Drainage of the subhepatic area should be done in these cases to prevent the development of subdiaphragmatic abscess. We did not institute such drainage in case 13 at the primary operation and a subdiaphragmatic accumulation of bile developed. This necessitated drainage through an Ochsner incision.

*Injuries of the transverse colon.* The 5 cases in this group are shown in Table XVI. Other cases in which there was injury to the transverse colon which was distinctly secondary to the major injury of another part of the colon are 5, 11, 35, 39 and 66. They do not comprise the 5 cases in this section.

Wounds of the transverse colon are easily handled for exteriorization without mobilization often is possible. Exteriorization is the method of choice. In case 18 successful closure of a wound in an exteriorized loop of bowel was done at the first operation. The patient was out of the hospital and well only 3 weeks after his injury. The patient in case 19 was treated by suture alone without complications; we believe it would have been wiser to exteriorize the sutured loop of bowel. The one patient who died (case 20) was properly treated but died despite treatment.

*Injuries of the splenic flexure.* These injuries, comprising 9 cases, are listed in Table XVII. The splenic flexure is the most difficult part of the colon to inspect, mobilize and exteriorize because of its inaccessibility. The spleen often is injured in addition to the flexure and splenectomy sometimes is necessary. Thus considerable surgical treatment often is indicated. We employed exteriorization in some cases and suture of the wound combined with transverse colostomy in others. We think the simpler procedure is better if the patient is not in good general condition. When severe wounds are present exteriorization is compulsory.

A Mikulicz type of colostomy was used in one case in which the flexure was completely divided by the missile.

TABLE XVII.—INJURIES TO THE SPLENIC FLEXURE STRUCTURES INVOLVED IN 9 CASES PRESENT SERIES

Structures Involved	Cases	Deaths
Splenic flexure alone		0
Splenic flexure, spleen	1	1
Splenic flexure, small bowel		
Splenic flexure, jejunum	1	
Splenic flexure, spleen, pancreas	1	
Splenic flexure, small intestine	1	1
Splenic flexure, spleen, liver or kidney	1	1
Splenic flexure, descending colon, jejunum	1	
Totals	9	

We think drainage of the left upper abdominal quadrant is desirable and that it should be dependent through a stab wound in the flank. In case 29 such drainage was not established and an abscess developed in the left upper abdominal quadrant and the patient died as a result. The death in case 28 probably was unavoidable. However, this patient might have been saved if he had been operated on and if an active bleeding point had been found and the bleeding controlled. This type of desperate case in which the patient does not respond well to shock therapy has been discussed herein in the section on the management of patients in desperate condition.

Among the structures injured in addition to the splenic portion of the colon is the diaphragm. It is most important to close any opening into the pleural cavity to prevent empyema. We had one patient in Italy in whom such a small diaphragmatic perforation was not closed, and empyema developed.

*Injuries of the descending colon.* The 8 cases in this group are listed in Table XVIII. Case 28 in which there was a wound of the splenic flexure is included in the section on injuries to that part of the colon and not in the present section although in this case the descending colon was damaged severely in the proximal part. The descending colon like the splenic flexure is inaccessible. In the mobilization of it and exteriorization of a damaged portion of it additional serious damage can be done to an already ill patient. However, some wounds must be exteriorized and in almost all our cases this treatment was used. In 2 cases, we think less surgical treatment might have given the patient a better chance of survival. The patient in case 37 had a retroperitoneal wound in both the right and left parts of the colon. Both

TABLE XVIII.—INJURIES TO THE DESCENDING COLON STRUCTURES INVOLVED IN 8 CASES  
PRESENT SERIES

Abdominal organs involved	Cases	Deaths
Descending colon alone	3	
Descending colon and kidney		
Descending colon and jejunum		
Descending colon, transverse colon, jejunum, and kidney		
Descending colon and caecum		
Totals	8	3

wounds were exteriorized only after long and extensive mobilization, which was enough to send the patient in shock, from which he never recovered, in spite of the repeated transfusion of blood. He could have been treated faster and less traumatically by the establishment of drainage down to the wounds in the colon, retroperitoneally through the flanks. He could then have undergone exploratory celiotomy with the establishment of an ileosigmoid anastomosis to deviate the fecal stream from the wounds in both the right and left portions of the colon. The condition of the patient in case 35 was desperate: there was a large intraperitoneal wound in the descending colon and a small wound in the transverse colon. We exteriorized the wounded part of the descending colon, the patient went back into profound shock and died. Our only alternative in such an instance would be to suture the large tear in the descending colon and exteriorize the wounded segment of transverse colon to deviate the fecal stream from the wounded part of the descending colon. In the suturing of such a large wound as this, we believe there is considerable danger of breakdown, although Gordon-Taylor reported that a wound 6 cm. long in the descending colon was sutured without complications.

Case 33 perhaps needs an explanation. The patient had sustained incomplete transection of the descending colon at its juncture with the splenic flexure. While the colon was being mobilized for a colostomy the patient went into shock. To cut the procedure short, the colon was divided completely and the end of the proximal segment was brought out through a subcostal stab wound. The open end of the distal segment was brought out through the wound in the back caused by the missile. This probably made the problem of re-establishment of the continuity of the colon more difficult for the surgeons at the base hospital. However to have continued mobilization of the splenic flexure and descending colon until

we could exteriorize both ends through a single wound would have been too shocking. Even after the shortened procedure, this man was very sick for a few days. On the basis of the reports already considered in this article, it would seem that reconstruction work on wounds of the colon can be accomplished with almost no mortality. Thus, the primary operation has as its prime purpose the saving of the life of the patient.

*Injuries of the sigmoid colon.* The 8 cases of wounds in this anatomic region are listed in Table XX. We think exteriorization is most satisfactory as a rule in the treatment of wounds of the sigmoid flexure. All of our patients except 2 were treated by this method. The patient in case 39 had wounds of the transverse colon; hence, he was treated by suture of the wound in the sigmoid and performance of transverse colostomy. We think it is sound surgery to employ suture with proximal colostomy in such a case. The sutured wound was of moderate size. Although from the record we cannot determine whether the loop of transverse colon was opened, we feel certain it was, because our policy was to defunctionalize a distal wounded segment of bowel in such a case.

The 3 deaths in this group require no comment, with the possible exception of the death in case 45. The patient was not operated on because of severe shock. We have considered problems such as this in the section on the management of patients whose condition is desperate.

*Injuries of the rectum.* The 6 cases of wounds of the intraperitoneal part of the rectum and the 17 cases of wounds of the extraperitoneal part of the rectum are listed in Table XX. In cases 64 and 65 it was not possible to determine the exact site of injury in the rectum.

Wounds of the intraperitoneal part of the rectum were treated by proximal colostomy and suture of the wound in the rectum. We had 6 cases of perforating wounds, and in 4 of these cases the wounds were complicated by injuries to multiple organs. All of the 4 patients died. The patient in case 66 had severe multiple abdominal injuries and a severe penetrating wound in the head. It was thought at autopsy that the chief cause of death was the wound in the head. The condition of the patient in case 67 was desperate: the patient did not respond to shock therapy and died during induction of anesthesia. His only chance was in operation. The patient in case 68 likewise was in desperate condition: he had been admitted in a state of severe shock, and responded poorly to shock therapy. He had massive fecal contamination of the peritoneal cavity. Death ensued shortly after operation: it was caused by the

TABLE XIX.—INJURIES TO THE SIGMOID FLEXURE STRUCTURES INVOLVED IN 8 CASES PRESENT SERIES

Structure involved	Cases	Deaths
Sigmoid flexure alone		
Sigmoid flexure, liver	1	
Sigmoid flexure, small intestine	1	
Sigmoid flexure, ileum, jejunum		1
Sigmoid flexure, spleen, stomach		
Sigmoid flexure, transverse colon, small intestine		
Sigmoid flexure, cecum, ileum	1	
Totals	3	1

severe shock in association with peritonitis. We believe that these 3 patients were properly handled and that death was inevitable.

In case 70 death resulted from the fact that a wound in the bladder had not been recognized at operation. This man withstood the operation fairly well. The rectal perforations were sutured. A urinary fistula developed postoperatively. We believe that the drainage of urine over the rectal sutures caused the wounds to break open and fecal fistulas to develop. Sepsis and hemorrhage occurred and death resulted.

Injury to the bladder commonly is associated with wounds of the rectum. Such injury was an associated lesion in 20 per cent of our 25 cases of wounds of the rectum, and was disastrous in the case in which we failed to detect it. Thus, it should be looked for carefully in rectal injuries. Cystoscopy carried out postoperatively allowed us to detect a suspected perforation of minute size in one case. Suprapubic cystostomy is indicated when a perforation of the bladder exists.

The small bowel also was injured in 4 of our 6 cases of injury to the intraperitoneal part of the rectum which made the condition more serious.

In our 17 cases of injuries to the extraperitoneal portion of the rectum there was but one death. These excellent results are due to our insistence on performance of proximal colostomy in every case combined with the institution of generous drainage of the spaces about the rectum. Furthermore, these wounds were not associated with injuries to multiple organs to the same extent as was true in the cases of injuries to the intraperitoneal part of the rectum. The small bowel was involved only once, and the bladder 3 times. The rectum was the only abdominal organ injured in 11 cases of injuries to the extraperitoneal part of the rectum.

Our one death in this group of wounds of the extraperitoneal part of the rectum occurred in Case

TABLE XX.—INJURIES TO THE RECTUM STRUCTURES INVOLVED IN 6 INTRAPERITONEAL WOUNDS AND 17 EXTRAPERITONEAL WOUNDS PRESENT SERIES

Structure involved	Cases	Deaths
Intraperitoneal wounds		
Rectum alone		
Rectum, ileum		1
Rectosigmoid, small intestine		
Rectum, bladder, ileum		1
Rectum, transverse colon, ileum, jejunum, bladder		
Totals	6	4
Extraperitoneal wounds		
Rectum alone	1	
Rectum, prostate gland		
Rectum, urethra		0
Rectum, bladder, ileum		
Rectum, bladder, prostate gland		
Rectum, bladder, spleen	1	
Totals	7	

69. The patient had sustained severe fractures, and débridement and rectal drainage had not been done thoroughly because the surgeon considered the patient's general condition to be too poor. Gas gangrene developed and the patient died. At autopsy severe pulmonary fat embolism was found. This, combined with traumatic shock and gas gangrene, accounted for the death.

In the case just described we used transverse colostomy because the mesentery was filled and distended with gas in the pelvis and along the sigmoid flexure. In case 66 transverse colostomy also was used because the patient had a wound of the transverse colon which we exteriorized. Usually sigmoidostomy is best in wounds of the rectum.

Coccygectomy was used in 6 cases in which the coccyx interfered with exposure, or drainage was thought to be inadequate with the coccyx left in place.

Suture of the wound in the rectum was a matter left to the discretion of the individual surgeon. We think that suture should be attempted at the first operation. As we have already shown some of these wounds heal after suture. If the wound stays closed, the main source of contamination—the lumen of the rectum—is shut off from the tissues about the rectum. This is an important step in the right direction.

## RÉSUMÉ 70 CASES OF INJURY TO THE LARGE INTESTINE AUTHORS' SERIES

Case	Part injured	Clinical history	Hours between injury and operation	Pathologic findings	Operative procedure	Comment
Cecum	Injured	12-1944 Penetrating wound, abdomen (shell fragment).	6	Two small retroperitoneal holes in cecum, spillage in peritoneal cavity	Cecum sutured, hairs sutured R (peritoneal drainage); rubber tube and cigarette drain through anterior stab wound.	Evacuated: 2-8-1944
Cecum	Injured	4-2-1945 Auto accident. Thrown against wheel.	44	Severe tear and slight constriction in cecum. Rest of the colon had small punctate hemorrhages. Cecum had two gangrenous areas (differential places, each about 6 in. long). Stomach had punctate hemorrhages 1.5 cm. c. bloody fluid in peritoneal cavity mild peritonitis with greenish areas of gut adherent to adjacent structures	Double resection of ileum with two end-to-end anastomoses.	Mild bilateral, acute bronchopneumonia. Evacuated: 2-4-45
Cecum	Injured	4-1-1945 Gun shot wound, perforating right flank, compressed comminuted fracture iliac crest.	13	Small tear in peritoneum of right lower quadrant, two small wounds perforating cecum. Knot wound perforated.	Enlargement, exploration of cecum, ileocecal junction, cecostomy, clearly loop of cecum retracted.	Cecum wounds opened spontaneously on and postoperative day 4. Evacuated: 2-2-45 good condition.
Cecum	Injured	11-19-44 Compressed comminuted fracture of right ileum	247	Perforating gunshot wound of entrance in lateral part of left lower quadrant, wound of exit in right buttock. Contusion on diameter on retroperitoneal part of cecum without perforation	Tract explored, wounds debrided. Cecum left in place, contused area not treated	Evacuated: 4-20-1945
Ileum	Injured	2-3-1945 Multiple wounds, left forearm, left buttock (shell fragment).	12	Compressed comminuted fracture right ileum, with perforation of cecum, transverse colon, liver. Cecum was ruptured, long tear extending from cecum into ascending colon.	Right colectomy ileostomy. Free ends of ileum and colon brought out through left inguinal stab wound in right upper quadrant.	Evacuated: 2-20-1945 Follow-up note bowel ends closed off, patient doing well.
Ascending colon	Injured	3-8-1945 Perforating gunshot wound, abdomen. Paritysis, both lower limbs. Comminuted fracture of iliac crest, lamina fourth lumbar vertebra.	23-34	Cecum perforated, body of fourth lumbar vertebra perforated. Large laceration through all of ascending colon at mesenteric border	Side to side ileostomy. Cecum, stump of ileum, ascending colon up to perforation exteriorized. Seven days later resection of redundant cecum and lower ascending colon, without anastomosis	Evacuated: 2-13-1945
Ascending colon	Injured	4-18-1945 Gun shot wound, abdomen	21	Ascending colon perforated just below hepatic flexure, laceration of liver, compressed comminuted fracture of right ileum	Cecum, ascending colon, hepatic flexure sutured, brought out as loop through right inguinal incision. Two holes in colon sutured, loop left unsutured	Severely postoperative dry patient doing well, colon loop still unsutured. Evacuated: 4-18-1945
Ascending colon	Injured	10-6-1944 Gun perforating, two penetrating, gunshot wounds, lower half of back		Small perforation, pleura of right chest over sixth rib, two lacerations of kidney, arterial tears in ascending colon, compressed comminuted fracture of 10th and 11th lumbar vertebrae and of left and right ribs. Damage to spinal cord.	Excision of right rib, closure of pleura. Mobilization of ascending colon for inspection. Suture of lacerations of kidney and ascending colon	Evacuated: 10-27-1944
Ascending colon	Injured	10-3-1945 Severe wound right lateral lumbar region of back (shell fragments)	21	Retroperitoneal wound, ascending colon draining in flank. Wound, right arm, thigh.	Ascending colon, cecum resected. Ileum sutured to transverse colon; end of transverse colon brought out through right abdominal stab wound	Junction, unknown cause infection of main abdominal wound. Evacuated 10-28-1945
Ascending colon	Injured	2-13-1945 Wound, right eye, right arm, right thigh, both legs (shell fragments)	30	Retroperitoneal hemorrhage lateral to ascending colon. Small perforation, middle part of retroperitoneal surface, ascending colon. Right iliac crest fractured	Ascending colon sutured. Hyle in colon sutured, loop colectomy	Evacuated: 2-13-1945 bowel suture has still intact

## RÉSUMÉ 70 CASES OF INJURY TO THE LARGE INTESTINE AUTHORS' SERIES—Continued

Case	Part Injured	Clinical history	Hours between injury and operation	Pathologic findings	Operative procedure	Comment
	Ascending colon	Injured 1 9-044 Rigid, tender abdomen, complete paralysis right lower extremity, partial paralysis of left.	14	Perforating wound abdomen (shell fragment) Peritoneal cavity filled with much dirty fecal-smelling bloody fluid; generalized peritonitis present. Ascending colon perforated twice, was dark, discolored, moderately infiltrated with fecal drainage. One small perforation in transverse colon. Compound fracture, lumbar vertebra.	Resection of terminal ileum, cecum, ascending colon and proximal transverse colon. Open ends of transverse colon and those sutured in approximation, brought out together as spur through stab wound in right upper quadrant.	Patient died 14 hours after operation. Was in severe shock at end of operation. Necropsy not performed. It is thought to be due to peritonitis and shock.
	Ascending colon	Injured about 17 044. At 1 d i p t d about, blood pressure not obtainable.	At least 9	Bullet traversed 5th lumbar vertebra, fractured right iliac crest. Large perforation in posterior aspect of cecum, also 1 pkilg mucous process in cecum, ascending colon.	Right colectomy. Neotransverseostomy; proximal end of colon brought out through stab wound. At end of operation, patient's condition very poor.	Patient died 14 hours after operation. Shock, sepsis thought the causes of death.
13	Hepatic flexure	Injured 3-10-045 Wound of back (shell fragments)	13	Fracture 4th lumbar vertebra, contusion right kidney perforation hepatic flexure of colon, perforation right lobe of liver	Ascending colon and hepatic flexure mobilized, holes in hepatic flexure closed. 11 pelvic flexure exteriorized as loop colectomy. Subdiaphragmatic space not drained.	Subdiaphragmatic accumulation of bile developed, was drained. E. accented: 3-30-045.
14	Hepatic flexure	Injured 6-30-045. Penetrating gunshot wound, right chest.	8	Bullet entered hepatic flexure of colon in intraperitoneal part; came out in extraperitoneal part, entered right kidney in upper pole, nicked liver	Duodenum was mobilized, no wound found. Hepatic flexure including wounded segment, exteriorized	Evacuated. 7-0-1945. Report on 8-3-045 Patient doing well. Colostomy at this time about to be closed.
15	Hepatic flexure	Injured 3-22-1945. Small right hemothorax; this was aspirated. Sensory paralysis below level of 5th thoracic vertebra.	At least 24	Bone fragments driven into caecum colica. Right diaphragm, liver retroperitoneal part of hepatic flexure perforated, right kidney severely contused.	Hepatic flexure mobilized, perforations sutured, damaged segment exteriorized as loop colectomy. While bladder was being distended for suprapubic cystostomy patient suddenly died.	Necropsy: bloody secretions partially obstructing bronchi, atelectasis, edema of right, left lower lobes; also contusion of right lower lobe.
16	Transverse colon	Injured. 30-045. Penetrating gunshot wound.	13	Two perforating wounds in jejunum; two in transverse colon.	All four perforations in bowel closed. Perforated area of transverse colon exteriorized.	Evacuated 4 7 1945; in good condition.
17	Transverse colon	Injured 9-045. Perforating gunshot wound, abdomen.	3	Perforation, left part of transverse colon, serosal tear in jejunum. Right lobe of liver perforated	Transverse colon exteriorized. 1 jun m t ed Liver area drained through right flank wound	E. accented: 5 4 1945; in good condition.
18	Transverse colon	Injured 5 17-045. Granular fragments. Penetrating wound, abdomen; small place omentum herniated through abdominal wound.	4	Perforation; transverse colon, cm. diameter. Peritonitis, abscess, posterior surface stomach, cm. diameter. Laceration cm. tail of pancreas. Splenic vein lacerated; profuse hemorrhage encountered. Retroperitoneal hemorrhage in left kidney region.	Perforations in stomach, colon sutured. Splenectomy. Suture of peritoneum over pancreas. Injured loop of transverse colon exteriorized.	Suture line in colon never broke down. 7 days post-operatively enteropneumothorax of colon was freed from abdominal wall, replaced in peritoneal cavity. On 7-045 patient discharged in excellent condition. Wound completely healed.
19	Transverse colon	Injured. 10-7-044. Multiple penetrating small wounds (shell fragments).	13	Two massive perforations, transverse colon. Compound comminuted severe fracture, left humerus, accompanied by left radial nerve injury	Wounds in transverse colon sutured; colectomy not performed.	Livacuated. 10-30-044.
20	Transverse colon	Injured: 4 045. In severe shock 3 arterial lacer.	5	Gunshot wound, perforating right chest wall through peritoneal cavity into left retroperitoneal space in left lower quadrant. Diaphragm lacerated, but pleural cavity not penetrated. Transverse colon perforated twice, jejunum four times; stomach twice. Laceration, furens of gall bladder; small laceration of liver. Generalized peritonitis. Compound fracture, left femur	Holes in large bowel, stomach, small bowel sutured. Cholecystectomy. Transverse colon exteriorized. Patient never recovered from shock; died 30 hours after operation.	Necropsy: moderate atelectasis of lower lobes of both lungs.

## RÉSUMÉ: 70 CASES OF INJURY TO THE LARGE INTESTINE AUTHORS' SERIES

Case	Part Injured	Clinical history	Hours between injury and operation	Pathologic findings	Operative procedure	Comment
	Cecum	Injured: 11-3-1944. Penetrating wound, abdomen (shell fragments).	6	Two small retroperitoneal holes in cecum, spillage in peritoneal cavity.	Cecum mobilized; holes sutured. 31 (report) cecum drained; rubber tube and cigarette drain through anterior abdominal wall.	Evacuated: 12-4-1944.
	Cecum	Injured: 4-27-1943. Auto accident; three gunshot wounds.	64	Several trans and slight contusions in cecum. First of the cecum had small punctate hemorrhages, dense lead two gangrenous areas in different places, each about 8 in. long. Sigmoid had punctate hemorrhages, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 380, 381, 382, 383, 384, 385, 386, 387, 388, 389, 390, 391, 392, 393, 394, 395, 396, 397, 398, 399, 400, 401, 402, 403, 404, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 427, 428, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 443, 444, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454, 455, 456, 457, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 472, 473, 474, 475, 476, 477, 478, 479, 480, 481, 482, 483, 484, 485, 486, 487, 488, 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 526, 527, 528, 529, 530, 531, 532, 533, 534, 535, 536, 537, 538, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557, 558, 559, 560, 561, 562, 563, 564, 565, 566, 567, 568, 569, 570, 571, 572, 573, 574, 575, 576, 577, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636, 637, 638, 639, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 667, 668, 669, 670, 671, 672, 673, 674, 675, 676, 677, 678, 679, 680, 681, 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 695, 696, 697, 698, 699, 700, 701, 702, 703, 704, 705, 706, 707, 708, 709, 710, 711, 712, 713, 714, 715, 716, 717, 718, 719, 720, 721, 722, 723, 724, 725, 726, 727, 728, 729, 730, 731, 732, 733, 734, 735, 736, 737, 738, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 749, 750, 751, 752, 753, 754, 755, 756, 757, 758, 759, 760, 761, 762, 763, 764, 765, 766, 767, 768, 769, 770, 771, 772, 773, 774, 775, 776, 777, 778, 779, 780, 781, 782, 783, 784, 785, 786, 787, 788, 789, 790, 791, 792, 793, 794, 795, 796, 797, 798, 799, 800, 801, 802, 803, 804, 805, 806, 807, 808, 809, 810, 811, 812, 813, 814, 815, 816, 817, 818, 819, 820, 821, 822, 823, 824, 825, 826, 827, 828, 829, 830, 831, 832, 833, 834, 835, 836, 837, 838, 839, 840, 841, 842, 843, 844, 845, 846, 847, 848, 849, 850, 851, 852, 853, 854, 855, 856, 857, 858, 859, 860, 861, 862, 863, 864, 865, 866, 867, 868, 869, 870, 871, 872, 873, 874, 875, 876, 877, 878, 879, 880, 881, 882, 883, 884, 885, 886, 887, 888, 889, 890, 891, 892, 893, 894, 895, 896, 897, 898, 899, 900, 901, 902, 903, 904, 905, 906, 907, 908, 909, 910, 911, 912, 913, 914, 915, 916, 917, 918, 919, 920, 921, 922, 923, 924, 925, 926, 927, 928, 929, 930, 931, 932, 933, 934, 935, 936, 937, 938, 939, 940, 941, 942, 943, 944, 945, 946, 947, 948, 949, 950, 951, 952, 953, 954, 955, 956, 957, 958, 959, 960, 961, 962, 963, 964, 965, 966, 967, 968, 969, 970, 971, 972, 973, 974, 975, 976, 977, 978, 979, 980, 981, 982, 983, 984, 985, 986, 987, 988, 989, 990, 991, 992, 993, 994, 995, 996, 997, 998, 999, 1000.	Double reaction of thrombus with end-to-end anastomosis.	Mild bilateral, acute bronchopneumonia. Evacuated: 5-45.
3	Cecum	Injured: 4-27-1943. Gunshot wound, perforating right flank; compound comminuted fracture of iliac crest.	12	Small tear in peritoneum of right lower quadrant; two small ovoid perforating cecum. Exit wound perineal.	Enlargement, exploration of with two end-to-end anastomosis.	Cecum wounds opened spontaneously on end postoperative day. Evacuated: 5-45; good condition.
	Cecum	Injured: 9-1-43. Compound comminuted fracture of right ilium.	42	Perforating gunshot wound, wound of entrance in ligand part of left lower quadrant, wound of exit in right buttock. Contusion on diameter on retroperitoneal part of cecum without perforation.	Tract explored, wounds debrided. Cecum left in place, contained area not treated.	Evacuated: 4-10-1943.
5	Ileum	Injured: 2-7-41. Multiple wounds, left femoral, left buttock (shell fragments).		Compound comminuted fracture right ilium, with perforation of cecum, transverse colon, lower cecum was entered; long tear extended from cecum into ascending colon.	Right colectomy, ileostomy. First ends of ileum and colon brought out through abdominal wall wound in right upper quadrant.	Evacuated: 2-20-41. Follow-up notes: bowel ends closed off, patient doing well.
6	Ascending colon	Injured: 2-6-1942. Penetrating gunshot wound, abdomen. Paril, no, both lower limbs. Compound fracture of right femur.	2-26	Cecum perforated body of fourth lumbar vertebra perforated. Large laceration through wall of ascending colon at mesenteric border.	Side-to-side ileocolostomy. Cecum, stump of ileum, ascending colon up to perforation exteriorized. On 10 days later, excision of redundant cecum and lower ascending colon, without anastomosis.	Evacuated: 2-27-1942.
7	Ascending colon	Injured: 4-1-43. Gunshot wound, abdomen.	12	Ascending colon perforated just below hepatic flexure, laceration of lower compound comminuted fracture of right ilium.	Cecum, ascending colon, hepatic flexure mobilized, brought out as loop through right abdominal incision. Two holes in colon entered; loop left suspended.	Survived, postoperative day 10. Patient doing well, colon loop still suspended. Evacuated: 4-14-43.
8	Ascending colon	Injured: 2-6-1942. Gunshot wound, two penetrating wounds, lower half of back.		Small perforation, pleura of right chest over sixth rib; laceration of kidney; several tears in ascending colon, compound comminuted fracture of 1st, 2nd, and 3rd lumbar vertebrae and of left and right ribs. Damage to spinal cord.	Reversion of right rib; closure of pleura. Mobilization of ascending colon, for anastomosis. Suture of lacerations of kidney and ascending colon.	Evacuated: 2-7-1942.
9	Ascending colon	Injured: 10-7-1944. Severe wound right lateral lumbar region of back (shell fragments).		Retroperitoneal wound, ascending colon dragging in back. Wound, right arm, thigh.	Ascending colon, cecum resected. Ileum anastomosed to transverse colon; end of transverse colon brought out through right abdominal wall wound.	Anastomosis, and lower chest resection of walls abdominal wound. Evacuated: 10-23-1944.
10	Ascending colon	Injured: 2-7-41. Wound, right eye, right arm, right thigh, both legs (shell fragments).	30	Retroperitoneal hemorrhage lateral to ascending colon; small perforation, middle part of retroperitoneal artery; ascending colon. Right iliac crest tract tract red.	Ascending colon mobilized. Hole in colon sutured; loop colectomy.	Evacuated: 2-7-1941. Lower rectum line still intact.

## RÉSUMÉ 70 CASES OF INJURY TO THE LARGE INTESTINE AUTHORS SERIES—Continued

Case	Part Injured	Clinical history	Hours between injury and operation	Pathologic findings	Operative procedure	Comment
	Ascending colon	Injured. 9-044. Right, tender abdomen, complete paralysis right lower extremity, partial paralysis of left.	74	Perforating wound abdomen (shell fragment). Peritoneal cavity filled with most dirty fecal-smelling bloody fluid, generalized peritonitis present. Ascending colon perforated twice, was dark, discolored, mesentery infiltrated with fecal drainage. One small perforation in transverse colon. Compound fracture, lumbar vertebra.	Resection of terminal ileum, cecum, ascending colon and proximal transverse colon. Open ends of transverse colon and ileum sutured in approximation; brought out together as spu. through stab wound in right upper quadrant.	Patient died in shock 4 hours after operation. Was in severe shock at end of operation. Necropsy not performed but death thought to be due to peritonitis and shock.
1	Ascending colon	Injured about 7-044. A (v d) (n p) (s d) shock, blood pressure not obtainable.	At least 9	Bullet traversed 5th lumbar vertebra, fractured right iliac crest. Large perforation in posterior aspect of ascending colon. Piles, mucosa, process involved, cecum, ascending colon.	Right colectomy. Ileotransverseostomy; proximal end of colon brought out through stab wound. At end of operation, patient's condition very poor.	Patient died 4 hours after operation. Shock, sepsis thought the causes of death.
13	Hepatic flexure	Injured 3-16-045. Wound of back (shell fragments).	3	Fracture 4th lumbar vertebra, confusion right kidney perforation hepatic flexure of colon, perforation right lobe of liver.	Ascending colon and hepatic flexure modified holes in hepatic flexure closed. Hepatic flexure exteriorized as loop colectomy. Subphrenic spaces not drained.	Subdiaphragmatic accumulation of bile developed, was drained. Evacuated 3-26-045.
14	Hepatic flexure	Injured 6-30-045. Penetrating gunshot wound, right chest.	5	Bullet entered hepatic flexure of colon in intraperitoneal part; came out in extraperitoneal part; entered right kidney in upper pole, nicked liver.	Duodenum was mobilized, no omentum found. Hepatic flexure, including omentum, exteriorized.	Evacuated 7-0-045. Report on 8-3-045 Patient doing well. Colectomy at this time about to be closed.
5	Hepatic flexure	Injured 3-24-045. Small right hemithorax. This was aspirated. Sensory paralysis below level of 5th thoracic vertebra.	At least 24	Bone fragments driven into cauda equina. Right diaphragm, liver, retroperitoneal loop of colon, hepatic flexure perforated; right kidney severely contused.	Hepatic flexure mobilized, perforations sutured, damaged segment exteriorized as loop colectomy. Urinary bladder was being distended for suprapubic cystostomy patient suddenly died.	Necropsy: bloody secretions partially obstructing bronchi; atelectasis, edema of right, left lower lobes, also contusion of right lower lobe.
6	Transverse colon	Injured 4-30-045. Penetrating gunshot wound.	1	Two perforating wounds in jejunum; two in transverse colon.	All four perforations in bow is closed. Perforated area of transverse colon exteriorized.	Evacuated 4-7-045 in good condition.
7	Transverse colon	Injured 5-10-045. Perforating gunshot wound, abdomen.	3	Perforation, left part of transverse colon; serosal tear in jejunum. Right lobe of liver perforated.	Transverse colon exteriorized. Liver in situ. Liver area drained through right flank wound.	Evacuated 5-4-045 in good condition.
18	Transverse colon	Injured 5-7-045. Granular inguinal. Penetrating wound abdomen, small piece omentum herniated through abdominal wound.	4	Perforation; transverse colon, cm. diameter. Perforation in wound, posterior surface stomach, cm. diameter. Laceration cm. tail of pancreas. Splenic vein lacerated; profuse hemorrhage encountered. Retroperitoneal hemorrhage in left kidney region.	Perforations in stomach, colon sutured. Splenectomy. Suture of peritoneum over pancreas. Injured loop of transverse colon exteriorized.	Suture line in colon never broke down, 17 days postoperatively sutured end loop of colon was freed from abdominal wall, replaced in peritoneal cavity. On 7-045 patient discharged in excellent condition. All wounds completely healed.
9	Transverse colon	Injured 0-17-044. Multiple penetrating small wounds (shell fragments).	13	Two minute perforations, 1.2 cm. area. Compound comminuted severe fracture, left humerus, accompanied by left radial nerve injury.	Wounds in transverse colon exteriorized; colectomy not performed.	Evacuated 0-20-044.
20	Transverse colon	Injured, 4-045. In shock 9 arterial lacer.	5	Gunshot wound, perforating right chest wall through peritoneal cavity into left rectus muscle in left lower quadrant. Diaphragm lacerated, but pleural cavity not penetrated. Transverse colon perforated twice; jejunum four times, stomach twice. Laceration, laceration of gall bladder, small laceration of liver. Generalized peritonitis. Compound fracture, left femur.	Holes in large bowel, stomach, small bowel sutured, cholecystectomy. Transverse colon exteriorized. Patient never recovered from shock; died 30 hours after operation.	Necropsy: moderate stilette of lower lobes of both lungs.

## RÉSUMÉ 70 CASES OF INJURY TO THE LARGE INTESTINE AUTHORS' SERIES

Case	Part Injured	Clinical history	Hours between injury and operation	Pathologic findings	Operative procedure	Comment
	Cecum	Injured: 2-13-1944. Fine stab wound, abdomen (shell fragments).	0	Two small retroperitoneal holes in cecum, epidural in peritoneal cavity.	Cecum mobilized, holes sutured. Retroperitoneal drainage rubber tube and cigarette drain through anterior stab wound.	Excised: 12-8-44.
	Cecum	Injured: 4-12-415. Auto-architect thrown against wheel.	64	Small tear and slight contusion in cecum. Rest of the colon had small punctate hemorrhages; lungs had two gangrenous areas at different places, each about 6 in. long; stomach had punctate hemorrhages 1.5 cm. bloody fluid in peritoneal cavity mild peritonitis with gangrenous areas of gut adherent to adjacent structures.	Double resection of ileum with two end-to-end anastomoses.	Right lateral, acute bronchopneumonia. Excised: 7-45.
3	Cecum	Injured: 3-4-45. Gunshot wound, perforating right flank, compound comminuted fracture iliac crest.	13	Small tear in peritoneum of right lower quadrant, two small wounds perforated cecum. Exit wound perforated.	Exploration, exploration of right lower quadrant. I was dissected and closed; loop of cecum exteriorized.	Cecum wounds opened spontaneously on second postoperative day. Excised: 3-21-45 good condition.
	Cecum	Injured: 2-9-1942. Compound comminuted fracture of right ilium.	24	Perforating gunshot wound, wound of entrance in lateral part of left lower quadrant, wound of exit in right buttock. Contusion on diameter on retroperitoneal part of cecum without perforation.	Tract explored, wounds debrided. Cecum left in place, contused area not treated.	Excised: 4-20-42.
5	Cecum	Injured: 2-7-415. Multiple wounds, left (abdominal), left buttock (shell fragments).	18	Compound comminuted fracture right ilium, with perforation of cecum, transverse colon, liver. Cecum was entered long tear extended from cecum into ascending colon.	Right colectomy ileostomy. Free ends of ileum and colon brought out through a bicolonic tap wound in right upper quadrant.	Excised: 2-20-1945. Follow-up notes: bowel ends closed off, patient doing well.
6	Ascending colon	Injured: 3-6-41. Perforating gunshot wound, abdomen. Paralytic, both lower limbs. Compound comminuted fracture fourth lumbar vertebra.	2-36	Cecum perforated, bod of fourth lumbar vertebra perforated. Large laceration through wall of ascending colon at mesenteric border.	Side-to-side ileotransverseostomy. Cecum, stump of ileum, ascending colon up to perforation exteriorized. Seven days later removal of redundant cecum and lower ascending colon, without anastomosis.	Excised: 3-27-415.
7	Ascending colon	Injured: 4-7-415. Gunshot wound, abdomen.	3	Ascending colon perforated just below hepatic flexure, laceration of liver; compound comminuted fracture of right ilium.	Cecum, ascending colon, hepatic flexure mobilized, brought out in loop through right iliac incision. Two holes in colon sutured, loop left unclosed.	Severely, postoperative dysentery, decub ulcers, colon loop still unclosed. Excised: 4-27-1945.
8	Ascending colon	Injured: 10-6-1944. Gunshot wound, two punctate wounds, lower half of back.		Small perforation, pieces of right chest over each rib, two lacerations of kidney; arterial tears in ascending colon, compound comminuted fracture of 1st, 2nd, and 3rd lumbar vertebrae and of left and right ribs. Damage to spinal cord.	Resection of right rib, closure of pleura. Mobilization of ascending colon for inspection. Suture of lacerations of kidney and ascending colon.	Excised: 10-7-1944.
	Ascending colon	Injured: 4-7-44. Severe wound right lateral lower rib region of back (shell fragments).		Retroperitoneal wound; ascending colon draining to back. Wounds, right arm, thigh.	Ascending colon, cecum resected. Ileum sutured to transverse colon; end of transverse colon brought out through right subcostal stab wound.	Jejunica, ulcers, colon, infection of meso abdominal wound. Excised: 10-27-44.
	Ascending colon	Injured: 1-27-1945. Wounds right eye, right arm, right thigh, back (shell fragments).	30	Retroperitoneal hemorrhage lateral to ascending colon. Small perforation, middle part of retroperitoneal surface ascending colon. Right iliac crest fractured.	Ascending colon mobilized. Hole in colon sutured, loop colectomy.	Excised: 1-27-1945. Bowel suture has still intact.



## RÉSUMÉ 70 CASES OF INJURY TO THE LARGE INTESTINE AUTHORS SERIES—Continued

Case	Part Injured	Clinical history	Hours between injury and operation	Pathologic findings	Operative procedure	Comment
	Ascending colon	Injured. 7-9-44. Rigid, tender abdomen. Complete paralysis right lower extremity partial paralysis of left.	14	Perforating wound abdomen (shell fragment). Peritoneal cavity filled with much clotted, focal-smelling bloody fluid, generalized peritonitis present. Ascending colon perforated twice, was dark, discolored; mesentery infiltrated with fecal drainage. One small perforation in transverse colon. Compound fracture, humerus vertebrae.	Resection of terminal ileum, cecum, ascending colon and proximal transverse colon. Open ends of transverse colon and ileum sutured in approximation, brought out together, spur through stab wound in right upper quadrant.	Patient died in shock 18 hours after operation. Was in severe shock, end of operation. Necropsy not p. fo m d b t d a t h thought to be due to peritonitis and shock.
1	Ascending colon	Injured about 7-9-44. A t d i p e l d blood pressure not obtainable.	At least 9	Bullet traversed 9th lumbar vertebrae, fractured right iliac crest. Large perforation in posterior aspect of ascending colon. Pyloric mucosa involved. Cancer, ascending colon.	Right colectomy. Mesenteric vessels proximal end of colon brought out through stab wound. At end of operation, patient's condition very poor.	Patient died 4 hours after operation. Shock, sepsis thought the causes of death.
13	Hepatic flexure	Injured 3-5-45. Wound of back (shell fragments).	23	Fracture 4th lumbar vertebra, contusion right kidney, perforation hepatic flexure of colon, perforation right lobe of liver.	Ascending colon and hepatic flexure mobilized, holes in hepatic flexure closed. Hepatic flexure exteriorized as loop colectomy. Subphrenic space not drained.	Subdiaphragmatic accumulation of bile developed, was drained. Evacuated. 3-20-45.
14	Hepatic flexure	Injured 6-30-45. Penetrating gunshot wound, right chest.	5	Bullet entered hepatic flexure of colon in intraperitoneal part; came out in extraperitoneal part, entered right kidney in upper pole, nicked liver.	Duodenum was mobilized, no omentum found. Hepatic flexure, including omentum segment, exteriorized.	Evacuated 7-0-45. Report on 8-5-45 Patient doing ill. Colectomy at this time about to be closed.
5	Hepatic flexure	Injured 3-24-45. Small right hemothorax; this was aspirated. Secondary paralysis below level of 5th thoracic vertebra.	At least 24	Bone fragments driven into cauda equina. Right diaphragm, liver retroperitoneal part of hepatic flexure perforated, right kidney severely contused.	Hepatic flexure mobilized, peritonitis treated, damaged segment exteriorized as loop colectomy. While bladder was being distended for suprapubic cystostomy, patient suddenly died.	Necropsy: bloody secretions partially obstructing bronchi; telecystitis, adenoma of right, left lower lobes, also contusion of right lower lobe.
16	Transverse colon	Injured 4-20-45. Penetrating gunshot wound.	1	Two perforating wounds in jejunum; two in transverse colon.	All four perforations in bowels closed. Perforated area of transverse colon exteriorized.	Evacuated 4-27-45; in good condition.
7	Transverse colon	Injured 5-10-45. Perforating gunshot wound, abdomen.	3	Perforation, left part of transverse colon; serosal tear in jejunum. Right lobe of liver perforated.	Transverse colon exteriorized, jejunum sutured. Liver area drained through right flank wound.	Evacuated 5-14-45; in good condition.
18	Transverse colon	Injured 3-7-45. Grade 4 fragments. Penetrating wound abdomen, small piece extruded herniated through abdominal wound.	4	Perforation transverse colon, cm. diameter. Perforation small, posterior surface stomach, cm. diameter. Laceration cm., tail of pancreas. Splenic cist lacerated, profuse hemorrhage encountered. Retroperitoneal hemorrhage in left kidney region.	Perforations in stomach, colon sutured. Splenectomy. Suture of peritoneum over pancreas. Injured loop of transverse colon exteriorized.	Suture line in colon never broke down 17 days post-operatively exteriorized loop of colon was freed from abdominal wall, replaced in peritoneal cavity. On 7-9-45 patient discharged in excellent condition. Wounds completely healed.
19	Transverse colon	Injured 6-7-44. Multiple penetrating small wounds (shell fragments).	13	Two minute perforations, transverse colon. Compound comminuted severe fracture, left humerus, accompanied by left radial nerve injury.	Wounds in transverse colon sutured; colectomy not performed.	Evacuated, 10-10-44.
20	Transverse colon	Injured, 4-9-45. In severe shock, arrival at clinic. Diaphragm lacerated, but pleural cavity not penetrated. Transverse colon perforated twice, jejunum four times, stomach twice. Laceration, lumen of gall bladder; small laceration of liver. Generalized peritonitis. Compound fracture, left femur.	15	Gunshot wound, perforating right chest wall through peritoneal cavity into left rectum muscle in left lower quadrant. Diaphragm lacerated, but pleural cavity not penetrated. Transverse colon perforated twice, jejunum four times, stomach twice. Laceration, lumen of gall bladder; small laceration of liver. Generalized peritonitis. Compound fracture, left femur.	Holes in large bowel, stomach, small bowel sutured, cholecystectomy. Transverse colon exteriorized. Patient never recovered from shock; died 30 hours after operation.	Necropsy: moderate atelectasis of lower lobes of both lungs.

## RÉSUMÉ 70 CASES OF INJURY TO THE LARGE INTESTINE AUTHORS' SERIES

Case	Part Injured	Clinical history	Hours between injury and operation	Pathologic findings	Operative procedure	Comments
	Cecum	Injured 11-3-1944. Penetrating wound, abdomen (shell fragments).	6	Two small retroperitoneal holes in cecum, spillage in peritoneal cavity.	Cecum mobilized; holes sutured. R. & L. peritonitis) drainage; rubber tube and cigarette drains through incisions with wound.	Evacuated 12-4-1944.
	Cecum	Injured 4-7-1941. Auto accident. Overrun against wheel.	6 1/2	Bursal tear and slight contusion in cecum. Rest of the colon had small punctate hemorrhages. Duodenum had two gangrenous areas at different places, each about 4 in. long. Stomach had punctate hemorrhages 1,500. Bloody fluid in peritoneal cavity; mild peritonitis with gangrenous areas of gut adherent to adjacent structures.	Double resection of ileum with two end-to-end anastomoses.	Mild bilateral, acute bronchopneumonia. Evacuated 2-4-45.
2	Cecum	Injured 4-5-1941. Gun shot wound, perforating right flank, compound comminuted fracture of scapula.		Small tear in perforation of right lower quadrant, few small wounds perforating cecum. Exit wound patent.	Enlargement, exploration of wound. Cecum sutured and closed, loop of cecum extended.	Cecum wounds opened spontaneously on 2nd postoperative day. Evacuated 1-2-45; good condition.
	Cecum	Injured 10-1941. Compound comminuted fracture of right ilium.	1 1/2	Perforating gunshot wound, wound of entrance in lateral part of left lower quadrant, wound of exit in right buttock. Contusion on duodenum on retroperitoneal part of cecum without perforation.	Tract explored, wounds debrided. Cecal ileitis present, contained area not treated.	Evacuated 4-10-1945.
5	Ileum	Injured 2-4-1941. Multiple wounds, left lumbar, left buttock (shell fragments).	12	Compound comminuted fracture right ilium, with perforation of cecum, transverse colon, lower cecum was entered, long tear extended from cecum into ascending colon.	Right colectomy. Ileotransverseostomy. Free ends of ileum and colon brought out through buccal stab wound in right upper quadrant.	Evacuated 2-20-1941. Follow-up notes. Wound ends closed off, patient doing well.
6	Ascending colon	Injured 3-18-1941. Perforating gunshot wound, abdomen. Paralysis, both lower limbs. Compound comminuted fracture of lumbar 1 with lumbar vertebra.	2-3 1/2	Cecum perforated, body of fourth lumbar vertebra perforated. Large laceration through wall of perforating colon at mesenteric border.	Side-to-side ileotransverseostomy. Cecum, stump of ileum, ascending colon up to perforation exteriorized. Seven day later excision of redundant cecum and lower ascending colon, without anastomosis.	Evacuated 3-28-1945.
7	Ascending colon	Injured 4-1-1941. Gun shot wound, abdomen.	12	Ascending colon perforated just below hepatic flexure, laceration of liver, compound comminuted fracture of right ilium.	Cecum, ascending colon, hepatic flexure mobilized, brought on as loop through right subcostal incision. Two holes in colon entered, loop left unopened.	Seventh postoperative day patient doing well, colon loop still unopened. Evacuated 4-7-1941.
8	Ascending colon	Injured 10-5-1944. Gun perforating, two punctate, deep, gunshot wounds, lower half of back.	12	Small perforation, places of right chest over each rib, two lacerations of kidney, normal injury in ascending colon, compound comminuted fracture of 1st, 2nd, 3rd lumbar vertebrae and of left and right ribs. Damage to spinal cord.	Resection of right rib, closure of pleura. Mobilization of ascending colon for inspection. Suture of lacerations of kidney and ascending colon.	Evacuated 10-7-1944.
	Ascending colon	Injured 10-1944. Severely wound right lateral lumbar region of back (shell fragments).		Retroperitoneal wound, ascending colon draining in back. Wounds, right arm, thigh.	Ascending colon, cecum resected. Ileum anastomosed to transverse colon; end of transverse colon brought out through right subcostal stab wound.	Paralysis, unknown cause, laceration of main abdominal wound. Evacuated 10-20-1944.
	Ascending colon	Injured 2-1-1944. Wounds, right eye, right arm, right thigh, both legs (shell fragments).	20	Retroperitoneal hemorrhage lateral to ascending colon. Small perforation, middle part of retroperitoneal artery, ascending colon. Right leg crest fractured.	Ascending colon mobilized. Hole in colon entered, loop colectomy.	Evacuated 2-3-1944. Bowel suture line still intact.

## RÉSUMÉ 70 CASES OF INJURY TO THE LARGE INTESTINE AUTHORS' SERIES

Case	Part Injured	Clinical history	Hours between injury and operation	Pathologic findings	Operative procedure	Comment
	Cecum	Injured 11-13-1944. Penetrating wound, abdomen (shell fragments).	6	Two small retroperitoneal holes in cecum spillage in peritoneal cavity	Cecum mobilized, holes sutured. R. trepan; anal drainage; rubber tube and cigarette drain through anterior stab wound	Evacuated 12-8-1944.
	Cecum	Injured 4-13-1945. Auto accident, thrown against wheel.	64	Several tear and slight contusion in cecum. First of the colon had small punctate hemorrhages, there had two gangrenous areas, different places, each about 6 in long stomach had punctate hemorrhages 2,000 cc. bloody fluid in peritoneal cavity and perforation of 1/2 gangrenous areas of gut adherent to adjacent structures	Double resection of ileum with two end-to-end anastomoses.	Mild bilateral acute bronchopneumonia. Evacuated 1-45
3	Cecum	Injured 4-25-1945. Gun shot wound, perforating right flank, compound comminuted fracture iliac crest.	3	Small tear in perforators of right lower quadrant (two small wounds perforating cecum. Exit wound para-umbilic)	Exploration, exploration of wound, 1/2 inch scal wounds, anastomosis and closed loop of cecum resected.	Cecum wounds opened spontaneously on and postoperative three day. Evacuated 3-45 good condition.
	Cecum	Injured 9-4-45. Compound comminuted fracture of right ilium	112	Perforating gunshot wound, wound of entrance in lateral part of left lower quadrant, wound of exit in right buttock. Communion on diameter on retroperitoneal part of cecum without perforation	Tract explored, wounds debrided. Cecum left in place, contained area not treated	Evacuated 4-30-1945.
5	Ileum	Injured 4-4-45. Multiple wounds, left forearm, left buttock (shell fragments)		Compound comminuted fracture right ilium, with perforation of cecum, transverse colon, liver. Cecum was entered, long tear extended from cecum into ascending colon.	Right colectomy. Ileostomy temporary. Free ends of ileum and colon brought out as a 1/2 inch incision in right upper quadrant.	Evacuated 3-30-1945. Follow-up note: bowel ends closed off, patient doing well.
6	Ascending colon	Injured 3-5-1945. Perforating gunshot wound, abdomen. Paralytic, both lower limbs. Compound comminuted fracture of both iliac laminae to the iliac vertebrae	12-36	Cecum perforated, body of fourth lumbar vertebra perforated. Large laceration through wall of ascending colon 1 centimeter border	End-to-side ileotransversecolostomy. Cecum, stump of ileum, ascending colon up to perforation exteriorized. Seven days later excision of abdominal cecum and ileum, ascending colon, without anastomosis.	Evacuated 3-13-1945
7	Ascending colon	Injured 8-1-45. Gun shot wound, abdomen	3	Ascending colon perforated just below hepatic flexure, laceration of liver; compound comminuted fracture of right ilium	Cecum, ascending colon, hepatic flexure, ligament mobilized, brought out as loop through right iliac fossa, incision 2 inches in right upper quadrant, loop still suspended.	Small, postoperative days; patient doing well, colon loop still suspended. Evacuated 4-3-1945.
8	Ascending colon	Injured 10-4-45. One perforating, two penetrating (shell fragments), lower left of back		Small perforation, pieces of right chest over both ribs, two lacerations of kidney, several tears in ascending colon, compound comminuted fracture of sac, and 3rd lumbar vertebrae each of left and right, the ribs. Damage to spinal cord	Excision of right rib, closure of pleura. Mobilization of ascending colon for inspection. Excision of lacerations of kidney and ascending colon	Evacuated 10-27-1944
	Ascending colon	Injured 9-3-1944. Severe wound, right lateral lumbar region of back (shell fragments)	11	Retroperitoneal wound; ascending colon dipping in back. Wounds right arm, thigh.	Ascending colon, cecum resected. Ileum sutured to transverse colon; end of transverse colon brought out through right iliac fossa stab wound.	Jejunum sutured close, laceration of main abdominal wound. Evacuated 10-23-1944
	Ascending colon	Injured 25-4-45. Wound, right eye, right arm, right thigh, both legs (shell fragments)	30	Retroperitoneal hemorrhage lateral to ascending colon. Small perforation, middle part of retroperitoneal surface, ascending colon. Right iliac crest fractured	Ascending colon mobilized. Hole in colon sutured, loop colectomy	Evacuated 4-1-1945. Bowel suture line still intact.

## RÉSUMÉ 70 CASES OF INJURY TO THE LARGE INTESTINE AUTHORS' SERIES—Continued

Case	Part Injured	Clinical history	Hours between injury and operation	Pathologic findings	Operative procedure	Comment
1	Ascending colon	Injured 11-9-04. Right tender abdomen, complete paralysis right lower extremity partial paralysis of left.	4	Perforating wound abdomen (small 4 cent.) Peritoneal cavity filled with much dirty focal-smelling bloody fluid, generalized peritonitis present. Ascending colon perforated twice, was dark, discolored, mesentery infiltrated with focal drainage. One small perforation in transverse colon. Compound fracture, lumbar vertebra.	Resection of terminal ileum, cecum, ascending colon and proximal transverse colon. Open ends of transverse colon and ileum sutured in approximation brought out together as spig through tab wound in right upper quadrant.	Patient died in shock 8 hours after operation. Was in severe shock at end of operation. Necropsy not performed but death thought to be due to peritonitis and shock.
	Ascending colon	Injured about 1-11-04. Shock, blood pressure not obtainable.	At least 9	Bullet traversed 5th lumbar vertebra, fractured right iliac crest. Large perforation in posterior aspect of ascending colon. Phlegmonous process involved cecum ascending colon.	Right colectomy ileotransverse anastomosis; proximal end of colon brought out through stab wound. At end of operation, patient's condition very poor.	Patient died 14 hours after operation. Shock, sepsis thought the causes of death.
13	Hepatic flexure	Injured 3-6-04. Wound at back (shell fragments).	3	Fracture 4th lumbar vertebra, contusion right kidney perforation hepatic flexure of colon, perforation right lobe of liver.	Ascending colon and hepatic flexure mobilized; holes in hepatic flexure closed. Hepatic flexure exteriorized as loop colostomy. Serphrenic space not drained.	Subdiaphragmatic accumulation of bile developed, was drained. Evacuated 3-20-04.
14	Hepatic flexure	Injured 6-30-04. Penetrating gunshot wound, right chest.	5	Bullet entered hepatic flexure of colon in intraperitoneal part, came out in extraperitoneal part; entered right kidney in upper pole, nicked liver.	Duodenum was mobilized, no wound found. Hepatic flexure including wounded segment, exteriorized.	Evacuated 7-10-04. Report on 8-3-04. Patient doing well. Colostomy 1 1/2 inches about to be closed.
5	Hepatic flexure	Injured 3-14-04. Small right hemithorax; this was aspirated. Sensory paralysis below level of 11th thoracic vertebra.	At least 24	Bone fragments driven into caecum caecum. Right diaphragm, liver retroperitoneal part of hepatic flexure perforated; right kidney severely contused.	Hepatic flexure mobilized; perforations sutured; damaged segment exteriorized as loop colostomy. While bladder was being distended for urographic cystostomy patient suddenly died.	Necropsy: bloody secretions partially obstructing bronchi atelectasis, adenoma of right, left lower lobes, also contusion of right lower lobe.
6	Transverse colon	Injured 4-30-04. Penetrating gunshot wound.		Two perforating wounds in jejunum two in transverse colon.	All four perforations in bowel closed. Perforated area of transverse colon exteriorized.	Evacuated 4-7-04. In good condition.
17	Transverse colon	Injured 5-04-04. Perforating gunshot wound, abdomen.	3	Perforation, left part of transverse colon; serosal tear in jejunum. Right lobe of liver perforated.	Transverse colon exteriorized, jejunum transposed. Left area drained through right flank wound.	Evacuated 5-14-04. In good condition.
8	Transverse colon	Injured 5-7-04. Orifice fragments. Penetrating wound abdomen, small pieces exsanguinated through abdominal wound.	4	Perforation transverse colon, cm. diameter. Perforated stomach, posterior surface stomach, cm. diameter. Laceration cm. tail of pancreas. Splenic vein lacerated; profuse hemorrhage encountered. Retroperitoneal hemorrhage in left kidney region.	Perforations in stomach, colon sutured. Splenectomy. Suture of peritoneum over pancreas. Injured loop of transverse colon exteriorized.	Suture line in colon never broke down 17 days post-operatively exteriorized loop of colon was freed from abdominal wall, replaced in peritoneal cavity. On 7-04 patient discharged in good condition.
19	Transverse colon	Injured 6-7-04. Multiple penetrating small wounds (shell fragments).	13	Two minute perforations, transverse colon. Compound comminuted severe fracture, left humerus, accompanied by left radial nerve injury.	Wounds in transverse colon sutured; colostomy not performed.	Evacuated 10-20-04.
20	Transverse colon	Injured 4-04-04. In severe shock at arrival. Chastity wound at face.	5	Gambol wound, perforating right chest wall through peritoneal cavity into left rectus muscle in left lower quadrant. Diaphragm lacerated, but pleural cavity not penetrated. Transverse colon perforated twice; jejunum four times, stomach twice. Laceration, lumen of gall bladder; small laceration of liver. Generalized peritonitis. Compound fracture left femur.	Holes in large bowel, stomach, small bowel sutured, cholecystectomy. Transverse colon exteriorized. Patient never recovered from shock; died 30 hours after operation.	Necropsy: moderate atelectasis of lower lobes of both lungs.

## RESUME 70 CASES OF INJURY TO THE LARGE INTESTINE AUTHORS' SERIES—Continued

Case	Part Injured	Clinical History	Hours between injury and operation	Pathologic findings	Operative procedure	Comment
	Splenic flexure	Injured 10-27-1944. Two penetrating wounds, left lateral chest wall (shell fragments)	30	Mesenter had ruptured pleural cavity; several small perforations in diaphragm; perforation splenic flexure of colon in four places. Spleen lacerated	Thoracotomy; three closures of diaphragm. Next, exploratory celiotomy. Stoma in splenic flexure entered transverse loop colostomy. Splenectomy	Evacuated; good condition. 9-44 in
11	Splenic flexure	Injured 3-3-1944. Penetrating wound, abdomen (shell fragments)	1	Splenic flexure of colon completely divided. Small bowels completely destroyed in places	Splenic flexure mobilized. Multiple double-barrelled colostomy performed. Four feet of jejunum resected	Evacuated 1-3-44 in excellent condition.
12	Splenic flexure	Injured 1-3-44. Penetrating wound of back (shell fragments)		Spleen lacerated, pancreas lacerated, splenic flexure perforated in two places	Splenectomy. Perforations in colon entered. Transverse colostomy. On 4-10-44 small loop of small intestine palpated through wound. Wound reentered. On 5-2-44, after 10 days of obstruction, operation was performed which showed (autopsy) no evidence of small intestine perforations at terminal part of ileum. Intussusception was freed and reduced	Evacuated 3-9-44, doing well
14	Splenic flexure	Injured 3-8-44	14	Large defect in left upper quadrant. Splenic flexure of colon and jejunum in two areas contained, without loss of vitality	Colostomy. Colostomy not done	Moderate atelectasis of both lungs developed. Evacuated 3-27-44
15	Splenic flexure	Injured 10-17-1944	8	One small perforation distal, one proximal, to splenic flexure tears transverse colon	Stoma of two wounds in colon; transverse colostomy	Massive atelectasis developed, but general condition of patient good. Evacuated 1-1-44
16	Splenic flexure	Exact time of wounding not known. In severe shock on admission; cyanotic, with large hematemesis on left	At least 24	Fracture of left tibiae by severe penetrating gunshot wound. Bullet then entered left axilla, lacerated left lower lobe of lung, left diaphragm, spleen, splenic flexure of colon, left kidney, liver. Perforation in splenic flexure 1 cm long. Large hemoperitoneum. Large, left retroperitoneal hematoma	Splenectomy; diaphragm sutured. Splenic flexure partially mobilized, hole in it sutured. Loop of transverse colon brought out through abdominal incision as colostomy	Patient died 4 hours after operation, never recovering from shock. During this time only 100 cc. of urine were secreted. Autopsy severe pulmonary fat embolism. Fragmented casts demonstrated in kidneys.
17	Splenic flexure	Injured 7-7-44		Hemoperitoneum (due with two perforations of splenic flexure of colon, one of small bowel. Kidney lacerated)	Perforation in small bowel closed, splenic flexure mobilized, injured segment of colon, sutured, through left subcostal stab wound as loop colostomy. As abdomen was being closed, respiratory and heart stopped; patient died	Autopsy: early post-operative pneumonia. Death due to shock, pneumonia.
18	Splenic flexure	Injured, 12-2-44. Admitted in severe shock. Shk. k. w. d. (I thought there was hemorrhage because of patient's dermal) course in spite of transfusion, as he refused to permit patient to open his eyes, thinking immediate operation was patient's only hope. Surgeon felt operation in patient's general shocked condition was hopeless, advised continued home therapy. Death occurred 6 hours after wounding		Peritoneal cavity contained fecal matter much blood. Large perforations in jejunum, splenic flexure of colon, descending colon. Kidney contained		Autopsy
20	Splenic flexure	Injured 11-19-1944		Five perforations, each about 8 mm diameter in splenic flexure, laceration of spleen	Wounds in colon placed; splenic flexure mobilized. During splenectomy severe hemorrhage from the splenic vessels encountered. Patient went into severe shock. Loop colostomy brought out in lateral angle of transverse incision, all placed wounds of splenic flexure externalized	Colostomy opened on the second postoperative day; began to function well. Patient died on seventh postoperative day. Autopsy showed shock, moderate gas, in left quadrant of abdomen; tubular pneumonia; moderate edema of liver.

## RÉSUMÉ 70 CASES OF INJURY TO THE LARGE INTESTINE AUTHORS' SERIES—Continued

Case	Part Injured	Clinical history	Hours between injury and operation	Pathologic findings	Operative procedure	Comment
30	Descending colon	Injured 9-7-04. Admitted to hospital 9-8-04. Perforating gunshot wound one wound in left flank one in right flank posteriorly; 3rd lumbar vertebra compound comminuted fracture severe cord damage.		Severe perforating wound, descending colon; left kidney moderately severely lacerated.	Wound of left colon exteriorized; suprapubic cystostomy done several days later.	9-12-04, severe meningitis developed, cleared up. Paralysis of lower extremities incomplete. Evacuated 9-04.
31	Descending colon	Injured 4-30-045	16	Multiple holes, descending colon, middle third. Loop of jejunum almost completely transected in two places; other holes present.	Five inches jejunum resected; end-to-end anastomosis performed. Splenic flexure mobilized; damaged segment of descending colon exteriorized.	Evacuated 4-30-045 doing well.
32	Descending colon	Injured 4-30-045 Tag of m t m k l t d through entrance wound	30	Three moderately large perforations, descending colon. Retroperitoneal tissues very dirty; lower pole of kidney knocked off.	Descending colon mobilized, perforations sutured, damaged part exteriorized.	Evacuated 9-2-045; in good condition.
33	Descending colon	Injured 4-8-045	23	Wound tract soiled, suppurated through t. Descending colon almost completely transected t junction with splenic flexure. Qe ral and perit nitis thick fibrinous coating over contents of left upper quadrant, most of small bowel.	Descending colon, distal part of splenic flexure mobilized, division of bowel completed. P m l d f l n brought out through subcostal stab wound; distal end through entrance wound in back. During procedure patient went into shock.	Evacuated 5-045; doing well.
34	Descending colon	Injured 2-1-045 Missile probably perforated abdomen, came out through wound in left upper quadrant just below costal margin, int. which loop of large bowel had herniated. General condition good.	36	Two perforations in descending colon on middle part was extraperitoneal other was 7 cm. distal.	Descending colon mobilized, injured part exteriorized through left McBurney incision.	Evacuated 2-4-045 in good condition.
35	Descending colon	Injured 4-3-045. Admitted in profound shock. P f rati g u k t wound, abdomen, small entrance wound in right upper quadrant. Exit wound, 3 cm. diameter, in left flank, from which 3 feet of jejunum, with four perforations in it, were herniated. Believed evaporation would help patient's general status, he was transferred to operating room. Perforations in jejunum sutured, then patient anesthetized with nitrous oxide-oxygen anesthetic for few minutes; bowel reduced. Cabotomy 18 hours after wounding; two hours after reduction of jejunum.	8	Two small perforations in transverse colon; 4 cm. perforation in descending colon. Moderate laceration, left kidney.	Descending colon wound exteriorized. Suture of transverse colon perforations. At end of operation patient in severe shock.	Patient did not recover from shock; died 8 hours postoperatively. Autopsy nothing additional.
36	Descending colon	Injured 8-10-044. Admitted severe shock; dyspnea, pale cyanotic. Recurrent tension pneumothorax, for which thoracotomy done. Perforating wound of left pleural cavity. Paralysis both lower extremities. Fecal drainage from left fl k w d Shock treated with 500 c.c. plasma oo wh l blood.	5	Massive retroperitoneal hematoma extending down into pelvis from left upper quadrant. No intraperitoneal perforation of colon. Was removed from local drainage from wound, tract of missile, and clinical and operative finding that there was perforating wound of retroperitoneal descending colon.	Left upper quadrant, flank, quickly explored through left paramedian incision. Patient went into profound shock, so abdomen was closed with loop of transverse colon, exteriorized. Death ensued few moments later.	No autopsy. Cause of death believed to be traumatic, operative shock.

## RÉSUMÉ. 70 CASES OF INJURY TO THE LARGE INTESTINE. AUTHORS' SERIES—Continued

Case	Part injured	Clinical history	Hours between injury and operation	Pathologic findings	Operative procedure	Comment
33	Splenic flexure	Injured 10-27-1944. Two penetrating wounds, left (lateral) chest wall (shell fragments).	20	Mesenter had ruptured splenic artery; several small perforations in diaphragm; perforation splenic flexure of colon in four places. Spleen lacerated.	Thymectomy; then, closure of diaphragm. Next, coloplastic colostomy. Spleen in splenic flexure sutured. Transverse loop colostomy. Splenectomy.	Evacuated good condition. 9-44; 1a
34	Splenic flexure	Injured 6-2-1944. Penetrating wound, abdomen (shell fragment).	1	Splenic flexure of colon completely divided. Small bow of completely destroyed in place.	Splenic flexure mobilized. Mikulicz double-barrelled colostomy performed. Four feet of jejunum resected.	Evacuated 1-13 9-44; 1a excellent condition
35	Splenic flexure	Injured 3-12-1944. Penetrating wound of back (shell fragment).	12	Spleen lacerated, pancreas lacerated; splenic flexure perforated in two places.	Splenectomy. Perforations in colon sutured. Transverse colostomy. On 2-4-1944 small loop of small intestine prolapsed through wound. Wound resected. On 3-2-1944, after 30 days of observation, open colon was performed which showed no absorption of 10 inches of small intestine; perforations at terminal part of ileum. Jejunostomy was tried and reduced.	Evacuated. 3-9-1944; doing well
36	Splenic flexure	Injured 3-12-1944	14	Large defect in left posterior quadrant. Splenic flexure of colon and jejunum in two areas contained, with loss of vitality.	Colostomy. Colostomy and ileostomy.	Moderate atelectasis of both lungs developed. Evacuated 3-27 1944.
37	Splenic flexure	Injured 10-7-1944	8	One small perforation distal, one proximal, to splenic flexure, between transverse colon.	Resection of two wounds in colon, transverse colostomy.	Massive atelectasis developed, but general condition of patient good. Evacuated 11-7-44.
38	Splenic flexure	Exact time of wounding not known. In severe shock on admission; cyanotic, with large hematomas on left.	At least 22	Fracture of left transverse by severe perforating gunshot wound. Bullet then entered left scapula, lacerated left lower lobe of lung, left diaphragm, spleen, splenic flexure of colon, left kidney, liver. Perforation in splenic flexure 2 cm. long. Large hemoperitoneum, large left retroperitoneal hematoma.	Splenectomy. Diaphragm sutured. Splenic flexure partially mobilized; hole in it sutured. Loop of transverse colon brought out through abdominal incision as colostomy.	Patient died 1 hour after operation, never recovering from shock. During this time only 50 c.c. of urine were secreted. Autopsy showed pulmonary fat embolism. Fragmented chest demonstrated in kidneys.
39	Splenic flexure	Injured 10-9-44		Hemoperitoneum (two) with two perforations of splenic flexure of colon, one of small bowel. Kidney lacerated.	Perforation in small bowel closed; splenic flexure mobilized, injured segment of colon exteriorized through left abdominal stab wound as loop colostomy. As abdomen was being closed, respiratory arrest and heart stopped; patient died.	Autopsy: early acidosis; extensive peritonitis. Death due to shock, peritonitis.
40	Splenic flexure	Injured 3-14-1944. Admitted in severe shock 5 1/2 h w d. It thought there was hemorrhage because of patient's decreased consciousness at site of transfusion, so left transfused patient in operating room, thinking immediate operation was patient's only hope. Several left operations in patient's present shock condition was hopeless; advised continued conservative therapy. Death occurred 18 hours after wounding.		Peritoneal cavity contained focal matter, much blood. Large perforations in jejunum, splenic flexure of colon, descending colon. Kidney contained.		Autopsy
41	Splenic flexure	Injured 10-9-44		Five perforations, each about 4 mm. diameter in splenic flexure laceration of spleen.	Wound in colon placed; splenic flexure mobilized. During splenectomy severe hemorrhage from the splenic vessels encountered. As blood went to serve shock, loop colostomy brought out in lateral angle of transverse incision, all seven wounds of splenic flexure exteriorized.	Colostomy opened on the second postoperative day; began to function well. Patient died on seventh postoperative day. Autopsy showed shock, moderate size in left quadrant of the colon; laceration transverse moderate edema of lumen.

## RÉSUMÉ 70 CASES OF INJURY TO THE LARGE INTESTINE AUTHORS' SERIES—Continued

Case	Part Injured	Clinical history	Hours between injury and operation	Pathologic findings	Operative procedure	Comment
30	Descending colon	Injured 9-7-1944. Admitted to hospital 9-8-44. Perforating gunshot wound, one wound in left flank; one in right flank posteriorly; 3rd lumbar vertebra: compound comminuted fracture severe cord damage.		Severe perforating wound, descending colon; left kidney moderately severely lacerated.	Wound of left colon exteriorized, separate cystostomy done several days later.	9-7-1944 severe meningitis developed; cleared up. Paralysis of lower extremities incomplete. Evacuated 9-21-1944.
31	Descending colon	Injured 4-30-1945	6	Multiple holes, descending colon, middle third. Loop of jejunum almost completely transected in two places; other holes present.	Five inches jejunum resected; end-to-end anastomosis performed. Splenic flexure mobilized; damaged segment of descending colon exteriorized.	Evacuated 4-30-1945 doing well.
32	Descending colon	Injured 4-30-1945. Tag of intestine in left flank through entrance wound.	30	Three moderately large perforations, descending colon. Retroperitoneal tissues very dirty; lower pole of kidney knocked off.	Descending colon mobilized; perforations sutured; damaged part exteriorized.	Evacuated 9-18-1945 in good condition.
33	Descending colon	Injured 4-22-1945.	23	Wound tract soiled, suppurative through it. Descending colon almost completely transected at junction with splenic flexure. Generalized peritonitis, thick fibrinous coating over contents of left upper quadrant, most of small bowel.	Descending colon, distal part of splenic flexure mobilized; division of bow. completed. P. in left flank brought out through subcostal stab wound, distal end through entrance wound in back. During procedure patient went into shock.	Evacuated 4-24-1945; doing well.
34	Descending colon	Injured 4-23-1945. Middle probably perforated abdomen, came out through wound in left upper quadrant just below costal margin, to which loop of large bowel had herniated. General condition good.	15	Two perforations in descending colon, one in middle part was extraperitoneal; other was 7 cm. distal.	Descending colon mobilized, injured part exteriorized through left McBurney incision.	Evacuated 4-24-1945; in good condition.
35	Descending colon	Injured 4-3-1945. Admitted in profound shock. Perforating gunshot wound, abdomen; small entrance wound in right upper quadrant. Exit wound, 3 cm. diameter in left flank, from which 3 feet of jejunum, with four perforations in it, were herniated. Believed eversion would help patient's general status; he was transferred to operating room. Perforations in jejunum sutured, then patient anesthetized with nitrous oxide-oxygen anesthesia for few minutes, bowel reduced. Colotomy 3 hours after wounding; two hours after reduction of jejunum.	18	Two small perforations in transverse colon 4 cm. perforation in descending colon. Moderate laceration, left kidney.	Descending colon wound exteriorized. Suture of transverse colon performed; distal end of operation placed in severe shock.	Patient did not recover from shock; died 8 hours postoperatively. Autopsy: nothing additional.
36	Descending colon	Injured 8-10-1944. Admitted in severe shock; dyspnoic, pale, cyanotic. Recurrent tension pneumothorax, for which twice thoracotomy done. Perforating wound of left pleural cavity. Paralysis both lower extremities. Fecal drainage from left flank wound. Shock treated with 500 cc. plasma.	5	Massive retroperitoneal hematoma, extending down into pelvis from left upper quadrant. No intraperitoneal perforation of colon. Was assumed, from fecal drainage from wound, tract of missile, and clinical and operative finding that there was perforating wound of retroperitoneal descending colon.	Left upper quadrant quickly explored; left paramedian incision. Patient went into shock, so abdomen closed with loop over colon. Death ensued a month later.	Autopsy: Cause of death shock; found to be traumatic. No other shock.



## RESUME. 70 CASES OF INJURY TO THE LARGE INTESTINE. AUTHORS' SERIES—Continued

Case	Part injured	Clinical history	Hours between injury and operation	Pathologic findings	Operative procedure	Comment
37	Descending colon	Injured 8-21-944. One small wound in each half, back over edge of each iliac fossa (grooves of inguinal).	29	Each wound tract led through compound fracture in corresponding ilium. Retroperitoneal perforation in both colons and descending colon. Retroperitoneal abscesses had developed behind and lateral to tear in descending colon. No peritonitis or contamination of the peritoneal cavity. Incision was first opened. Later severe spillage of abscess contents, with spread of feces and pus into peritoneal cavity.	Performed cecum mobilized, exteriorized through right iliofemoral incision. Descending colon mobilized, wounded segment exteriorized. During procedure patient went into profound shock and died.	Autopsy: small number of fat emboli in capillaries of pulmonary artery. No evidence of renal dam. Cause of death shock.
38	Sigmoid colon	Injured 8-23-944. Multiple penetrating wounds, junctions, ascum (shell fragments). Penetrating wound left side of chest. Hemoperitoneum, no pus present.	34	Muscle entered left chest, lacerated lower lobe left lung, perforated the pleural cavity, perforated stomach in two places. Three perforations in sigmoid colon.	Incision in sigmoid colon placed, injured loop exteriorized. Feces in the stomach placed.	Postoperative course very stormy; development of pulmonary abscesses. Report type of contamination; vomiting; patient became comatose. After making appearance of patient, looking better from pulmonary fever subsided. Excised 5-10-947 still alive.
39	Sigmoid colon	Injured 3-10-944. Perforating wound, abdomen, from which pieces of small bowel protruded. Severe shock.	7	Two small perforations in transverse colon, one perforation in sigmoid, one diameter small hole completely divided, a large hole present in area of 3 feet.	Colon perforations exteriorized, transverse colon, one perforation in right upper quadrant, 3 feet of jejunum resected, side-to-side anastomosis done.	Excised about 5 days postoperatively; doing ill.
40	Sigmoid colon	Injured 3-20-944. One shot wound at abdomen, from which contents herniated.	12 1/2	Large hemoperitoneum. Free perforations of jejunum, two perforations of ileum, laceration of mesenteric, contusion of sigmoid colon. Early peritonitis.	Twelve inches of jejunum resected, perforation in ileum exteriorized, contained sigmoid exteriorized.	Injured colon remained in place. Obstruction of small bowel developed, caused by adhesions, which were divided. Second operation. Excision 4-10-944.
41	Sigmoid colon	Injured 3-0-945.	26	Perforation, sigmoid colon, right lobe of liver perforated.	Perforation of sigmoid colon closed, brought out as loop colostomy.	Excised 3-18-1945 at which time sigmoid perforation had not repaired.
42	Sigmoid colon	Injured 4-8-945.		Grating wound in sigmoid colon (about perforation) 1 cm diameter, penetrated into muscularis.	Sigmoid wound exteriorized.	Abdominal distention developed which necessitated opening of colostomy. Excised 4-19-945.
43	Sigmoid colon	Injured 3-19-944.	5	Perforating wound, junction of descending colon, sigmoid. Small perforative wound (1 cm) on posterior surface. One perforation found in terminal ileum.	Perforation in colon exteriorized, descending colon, sigmoid mobilized, exteriorized. Perforations in ileum closed. Cecum exteriorized.	7 days died, with postoperative day. Autopsy severe generalized peritonitis.
44	Sigmoid colon	Injured 8-29-944.	70	One perforation of sigmoid colon, three perforations of small bow. Compound fracture, humeral; removal of left pelvis and left tibia; colostomy.	Perforations in small bow exteriorized. Left sigmoid loop colostomy.	Patient, at end of operation, in profound shock from which he never recovered.
45	Sigmoid colon	Injured 8-23-944. Admitted 8 hours after injury. Hyperextended. Wound in sigmoid from extruding feces. Patient almost dead from shock. Systolic blood pressure up to 100 mm. Hg. Pulse barely palpable. No shock period. Died 12 hours after admission.				Autopsy: generalized peritonitis, free fecal contamination. 3 severe hemoperitoneums. Three perforations in sigmoid colon, each about 3 cm diameter. Perforation of ileum, of jejunum.
46	Sigmoid colon	Injured 10-1-1944.	33	Compound fracture coccyx, extensive retroperitoneal hematomas in pelvis. Rectosigmoid colon perforated. Laceration of sigmoid colon; two small perforations in small bowel.	8 inch wound divided, coccyx exteriorized. All wounds of bowel exteriorized. Left lower quadrant loop colostomy performed.	Excised 9-4-1944 in good condition.

## RÉSUMÉ 70 CASES OF INJURY TO THE LARGE INTESTINE AUTHORS SERIES—Continued

Case	Part Injured	Clinical history	Hours between injury and operation	Pathologic findings	Operative procedure	Comment
47	Rectum	Injured 8-30-044. Compound comminuted complete fractures, both ischuria, left pubic bone.	At least 4	Focal abscess between bladder and left pubic bone. Upright urethra and rectum below peritoneal reflection were perforated.	Suprapubic cystotomy; focal abscess drained; sigmoid loop colostomy; debridement of other wounds.	Evacuated 9-3 044 post-ill d 11 g f m bsc cavity
48	Rectum	Injured 10-12-1944.		Large extraperitoneal tear of rectum, into prostate; extensive retroperitoneal hemorrhage in pelvis.	Rectum was debrided down to rectum; drainage established. Sigmoid colostomy; suprapubic cystotomy.	Minute perforating wound of bladder pipisture, debrided by cystoscopy. Evacuated 3-044 in good condition.
49	Rectum	Injured 1-14-044.	15	Rectum comminuted with both left buttock wound and extraperitoneal perforation of bladder. Intraperitoneal perforation of bladder. Left pneumothorax; perforated diaphragm; stellate fracture of spleen. Large hemoperitoneum.	Sigmoid colostomy. Intraperitoneal perforation of bladder sutured. Splenectomy. Suprapubic cystotomy. Left chest aspirated.	Evacuated 27-1944. On 7th day postoperatively, cystoscopy disclosed that rectovesical fistula had become closed. On 3-26-044 patient's general condition was good.
50	Rectum	Injured 4-8-045. Compound comminuted fractures, right ischial tuberosity left pubic bone.	13	Stellate perforation involving the anterior and lateral wall, lower rectum anus. Urethra lacerated.	All wounds debrided. Laceration of membranous urethra repaired, suprapubic cystotomy. Sigmoid loop colostomy.	Evacuated 4-8-045; doing well.
51	Rectum	Injured 4-24-045.	18	Perforating wound, anterior wall of rectum, posterior aspect right lateral lobe of prostate with compound comminuted fracture of ischium.	N. intra-abdominal injury. Exploratory cystotomy. Suprapubic catheter inserted. Buttock wound debrided, drainage established down to rectum. Sigmoid loop colostomy.	Evacuated 4-28-1945; doing well.
52	Rectum	Injured 4-3-045. Perforation of rectum, sigmoid, small bowel herniated through exit wound.	20	Wound tractled through perforation right lateral wall of rectum in extraperitoneal portion into bladder which had intraperitoneal perforation 5 inches long. Three feet of ileum had multiple perforations, one transection. Extensive peritonitis.	Resection, 3 1/2 feet (ileum). Bladder sutured. Suprapubic cystotomy sigmoid loop colostomy. Buttock wound debrided down to rectal wound.	Evacuated 5-8-045; doing well.
53	Rectum	Injured 4-26-1945	4	Perforation in traperitoneal portion of rectum much gross focal rotting; generalized peritonitis.	Rectum sutured. Sigmoid loop colostomy. Buttock wound debrided.	Fourth day postoperatively: cystoscopy of rectovesical fistula. Suprapubic cystotomy. Evacuated 5-4-045 in good condition.
54	Rectum	Injured 8-30-044. Operation 8-3-044.	3	Laceration, lower part of rectum.	Loop sigmoid colostomy. Buttock wound debrided down to rectum.	Patient had low-grade fever. Evacuated 9-4-044.
55	Rectum	Injured 7-29-044.	Probably 24	Small hemorrhagic retroperitoneal hemorrhage. Severe perforation, extraperitoneal rectum.	Exploratory cystotomy. Buttock wound only partially debrided because of severe shock. Sigmoid loop colostomy.	After 30 hours, further debridement of buttocks, coccygectomy carried out. Evacuated 9-3-044 doing well.
56	Rectum	Injured 9-4-044. Open wound left buttock; severe compound comminuted fracture ilium.	26	Severe perforation, extraperitoneal portion of rectum.	Buttock wound debrided. Coccygectomy. Sigmoid colostomy.	Evacuated 6th day postoperatively.
57	Rectum	Injured 9-10-1944.	26	Wound 6 cm. in diameter. Right buttock wound debrided. feces contained with hole 1 cm. in diameter in posterior wall of extraperitoneal part of rectum.	Buttock wound debrided. Exploratory colostomy. Loop sigmoid colostomy.	After about 6 months, the colonic stoma still in use. Coccyx had been resected; buttock wound was still draining.
58	Rectum	Injured 2-5-044.	10	Fracture coccyx as seen right ischium; moderately large perforating, round posterior aspect of rectum.	Buttock wound debrided. Coccygectomy. Sigmoid colostomy.	Evacuated 1-045.
59	Rectum	Injured 26-045.	13	One perforation of rectum in junction with vesical fold of peritoneum. Two other perforations 4 inches higher up in rectovesical cul-de-sac.	All three perforations in bowel closed. Sigmoid loop colostomy.	Unfavorable course. Evacuated 2-1-1945.

## RESUME 70 CASES OF INJURY TO THE LARGE INTESTINE AUTHORS STRICKS—Continued

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## RÉSUMÉ 70 CASES OF INJURY TO THE LARGE INTESTINE AUTHORS' SERIES—Continued

Case	Part injured	Clinical history	Hours bet. injury and operation	Pathologic findings	Operative procedure	Comment
47	Rectum	Injured. 8-29-044. Compound comminuted complete fracture, both femurs, left pubic bone.	At least 24	Fecal abscess between bladder and left pubic bone. Upper urethra and rectum below peritoneal reflection were perforated.	Suprapubic cystostomy; fecal abscess drained; sigmoid loop lost my débridement of other wounds.	Evacuated. 9-3-044; possible $\frac{1}{2}$ l m. bacco cavity
48	Rectum	Injured. 10-3-044.	10	Large extraperitoneal tear of rectum, into prostate; extensive retroperitoneal hemorrhage in pelvis.	B. stock wound débrided; down t. rectum drainage established. Sigmoid colostomy. Suprapubic cystostomy.	Mia is perforating wound of bladder pipelot size disc. d by cyst copy. Evacuated. 12-3-044. In good condition.
49	Rectum	Injured. 14-044.	15	Rectum communicated with both left buttock wound and extraperitoneal perforation of bladder. Intra-peritoneal perforation of bladder. Left pneumothorax, perforated diaphragm, sternal fracture of plectra. Large hemoperitoneum.	Sigmoid colostomy. Intra-peritoneal perforation of bladder sutured. Splenectomy. Suprapubic cystostomy. Left chest aspirated.	Evacuated. 1-27-044. On 17th day postoperatively cystoscopy disclosed that rectovesical fistula had become closed. On 3-16-044 patient's general condition was good.
50	Rectum	Injured. 4-8-045. Compound comminuted fractures, right ischial tuberosity, left pubic bone.	12	St. Hila perforation involving the anterior and lateral wall, lower rectum, anus. Urethra lacerated.	All wounds débrided. Laceration of membranes urethra repaired, suprapubic cystostomy. Sigmoid loop colostomy.	Evacuated. 4-5-045 doing well.
51	Rectum	Injured. 4-24-045.	8	Perforating wound, anterior wall of rectum, posterior aspect right lateral lobe of prostate with compound comminuted fracture of ischium.	1. Intra-abdominal injury. Exploratory cystostomy. Suprapubic catheter inserted. B. stock wound débrided, drainage established down to rectum. Sigmoid loop colostomy.	Evacuated. 4-30-045 doing well.
52	Rectum	Injured. 4-3-045. Perforating wound of abdomen. Small bowel herniated through exit wound.	20	Wound tract led through perforation right lateral wall of rectum in extraperitoneal portion into bladder which had intraperitoneal perforation 5 inches long. Three feet of ileum had multiple perforations, one transection. Extensive peritonitis.	Reversion, 15 feet ileum. Bladder sutured. Suprapubic cystostomy. Sigmoid loop colostomy. B. stock wound débrided down t. rectal wound.	Evacuated. 5-7-045 doing well.
53	Rectum	Injured. 4-26-1943.	14	Perforation (intra-peritoneal) portion of rectum much gross fecal soiling; generalized peritonitis.	Rectum sutured. Sigmoid loop colostomy. B. stock wound débrided.	Fourth day postoperatively cystoscopy of rectovesical fistula. Suprapubic cystostomy. Evacuated. 5-4-045 in good condition.
54	Rectum	Injured. 8-20-044. Operation 8-31-044.	3	Laceration, lower part of rectum.	Loop sigmoid colostomy. B. stock wound débrided down t. rectum.	Patient had low-grade fever. Evacuated. 9-4-1944.
55	Rectum	Injured. 7-20-1944.	Probably 24	Small hemorrhage marked retroperitoneal hemorrhage. Severe perforation, extraperitoneal rectum.	Exploratory colostomy. B. stock wound only partially débrided because of severe shock. Sigmoid loop colostomy.	After 30 hours, further débridement of buttocks, coccyx my cartil. t. Evacuated. 9-3-1944; doing well.
56	Rectum	Injured. 9-4-044. Gunshot wound left buttock severe compound comminuted fracture ilium.	26	Severe perforation, extraperitoneal portion of rectum.	B. stock wound débrided. Coccyx my Sigmoid colostomy.	Evacuated. 6th day postoperatively.
57	Rectum	Injured. 9-29-1944.	26	Wound 6 cm. diameter in right buttock wound débrided feces comminuted with hole cm. diameter posterior wall of extraperitoneal part of rectum.	B. stock wound débrided. Exploratory colostomy. Loop sigmoid colostomy.	After about 6 months, the colostomy tube still in use. Coccyx had been resected, buttock wound was still draining.
58	Rectum	Injured. 11-15-1944.		Fracture coccyx, right ischium, moderate large perforating wound, posterior aspect of rectum.	B. stock wound débrided. Coccyrectomy. Sigmoid colostomy.	Evacuated. 045.
59	Rectum	Injured. 12-044.	1	One perforation of rectum, 1 fracture with vascularized perforation. Two other perforations, 1 inches diameter, 1 rectovesical colon.	All three perforations closed. Sigmoid loop colostomy.	Urethral catheter. Evacuated. 1-045.

## RÉSUMÉ. 70 CASES OF INJURY TO THE LARGE INTESTINE. AUTHORS' SERIES—Continued

Case	Part Injured	Clinical History	Time between Injury and operation	Pathologic Findings	Operative procedure	Comment
50	Rectum	Injured 2-8-1943. Open from 2-8-1943 9:45 A.M.		Fracture, cecum perforation. On 12 diameter extraperitoneal rectum.	Sigmoid loop colostomy. Buttock wound debrided. Cecostomy.	Evacuated 2-8-1943; doing well.
51	Rectum	Injured 2-26-1943.	11	Perforation, on descending rectum, just above anus.	Buttock wound debrided. Sigmoid loop colostomy.	Evacuated 2-27-1943; good condition.
52	Rectum	Injured 2-3-1943. Fracture, rectum.	25	Perforation, anterior posterior wall, extraperitoneal part of rectum.	Cystostomy. Sigmoid loop colostomy. Sacral wound debrided; retrorectal incision drained.	Periprosthetic cystostomy required because patient unable to void. Evacuated 2-8-1943; in good condition.
53	Rectum	Injured 4-1-45. Perforation gunshot wound entered left buttock, exit via left groin.	4	Compound comminuted fracture, pelvis, ischium. Metallic foreign body lodged in muscle of rectal wall, but perforation into lumen of rectum not proved.	Sigmoidoscopy. Sigmoid loop colostomy.	Evacuated 4-12-1945. On 2-3-1945, buttock wound was almost healed; rectum seems still in use.
54	Rectum	Injured 2-7-1943.	18	Sigmoidoscopy showed moderate amount of fresh blood coming from perforated colon, but no hole seen in wall of colon. Extraperitoneal hemorrhage along anterior wall of rectum and retroperitoneal colon. Compound comminuted fracture, ilium.	Sigmoid loop colostomy. Extracutaneous wound debrided.	Evacuated 2-22-1943.
55	Rectum	Injured 2-27-1944.	64	Retrorectal contusion posterior wall rectum appeared sufficiently contained to warrant colostomy.	Rectum mobilized, shell fragment removed. Sigmoid loop colostomy. Buttock wound debrided.	Abductile of lower lobe, left lung developed; patient very ill, about 5 inches of sigmoid colon herniated through colostomy wound. Evacuated about 24th post-operative day; in good condition.
56	Rectum	Injured 2-1944. Multiple wounds (shell fragments).	22	Rectosigmoid perforated; arterial and venous lacerations in transverse colon, but no perforation. Ischium perforated extraperitoneally; divided. One intraperitoneal, one extraperitoneal perforation, moderate size, in bladder. Foreign penetrating wound, left frontal region, compound comminuted fracture of skull.	Perforations in ileocecum and bladder sutured. End to end anastomosis at point of divided ileum. Transverse loop colostomy. Cystostomy inserted in bladder allowed to empty through lower part of abdominal incision. Wound debrided. Ischial defect closed with pedicled patch.	Abductile of left lower lobe present because dyspnea, cyanosis. Died on 4th post-operative day. Autopsy: (b) (d) m thought to be main cause of death. Also Rasmussen pneumonia, arteriovenous malformation of lung, multiple small abscesses of that lobe.
57	Rectum	Injured 2-20-1945. Admitted in severe shock, pale, without perceptible blood pressure. Rapidly trends to death. Died in left buttock. During 24 hours postoperative patient received 2,000 cc. whole blood. Later blood pressure 120/80. Thought to have shock. Perforations were present.	64			Patient died during bacteremia. Colostomy performed shortly to stop hemorrhage, if present, and to permit drainage of heart. It was of no avail. About 1200 cc. of fresh bleeding blood in peritoneal cavity; generalized peritonitis. Large hole, anterior aspect of rectum, and incision proximal to coccygeal resection. Free perforations in ileum. Large retroperitoneal pelvic hematoma.
58	Rectum	Injured 2-27-1944.	22	Time 3 cm. long in rectum. Great local contamination early perforation. Small bladder twice.	Sacral wound debrided. Colostomy. Sacral bladder perforations sutured. Sigmoid loop colostomy. Presumptive cystostomy. Two sets of distal ileum resected.	Patient died 27 hours after operation. Death believed due to traumatic, operative shock, aggravated by gross local contamination.

## RÉSUMÉ 70 CASES OF INJURY TO THE LARGE INTESTINE AUTHORS' SERIES—Continued

Case	Part Injured	Clinical history	Hours between injury and operation	Pathologic findings	Operative procedure	Comment
69	Rectum	Injured 0-5 1944.	2	One perforation on each lateral wall of rectum, both retroperitoneal, cm diameter. Marked retroperitoneal hemorrhage about rectum, sigmoid bladder Gas, massive amounts, extended retroperitoneally from rectum up along descending colon, 1 to sigmoid anastomosis. Compound fractures, left humerus, left femur	Celiotomy Transverse loop colostomy. Buttock wound debrided distal rectum closed. Nothing done to remaining wounds because surgeon felt patient would not tolerate further surgery. Condition remained poor and on the second postoperative day gas gangrene detected in left arm. Second operation left arm amputated lower as trematous wounds debrided. Patient condition was poor during procedure; remained in hospital shortly afterward.	Autopsy: subcutaneous emphysema, whose left hemithorax and muscle section taken from shoulder showed no evidence of clostridial myositis. Pathologist: "Severe left pulmonary embolism so severe that it was probably the immediate cause of death. Moderate nonfatal renal embolism. Death due to combination of traumatic and operative shock, gas gangrene pulmonary fat embolism."
70	Rectum	Injured 8-4 1945.	5	Perforating gunshot wound entrance above symphysis pubis exit in left buttock. Severe hemorrhage, region of hypogastric vein. Two intraperitoneal perforations (rectum) three (distal ileum). Gross fecal material, incompletely digested food (small bowel contents) in peritoneal cavity	Celiotomy. Bleeding vein ligated. Perforation in ileum closed. Sigmoid loop colostomy. Left buttock wound debrided.	Second day postoperatively 1000 c.c. urine from fluid evacuated from peritoneal cavity. Catheter left in situ; drained approximately 1000 c.c. day. Cystoscopy 7 days after operation. Suprapubic catheter inserted; 3 days after operation fecal fistula developed about suprapubic catheter. Next day severe hematuria through anal abdominal incision, patient went into severe shock; was operated on. One perforation in rectum had responded as required. Fecal material extruded through colostomy through colostomal wound. Patient died 16 days after injury. Autopsy 5 cm. perforation in distal ileum just opposite suture line in gut; from this hole feces were extruding. Fecal matter could be expressed from one of rectal suture lines. Two perforations, each about 5 mm in diameter found in intraperitoneal part of bladder. Generalized fibrinopurulent peritonitis. Death due to peritonitis, which developed result of missing two small trapezoidal holes in bladder (first operation).

Case 64 cannot be classified exactly. The patient had some blood in the area of the rectosigmoid as seen at proctoscopy before the operation. No perforation was found. At celiotomy there was hemorrhage about the rectosigmoid. In any case such as this one in which damage is suspected even though not proved we think colostomy should be done.

## SUMMARY AND CONCLUSIONS

Seventy cases of injury to the colon and rectum in which the patients were treated in an evacuation hospital with a mortality rate of 27 per cent are presented. The literature is reviewed. Im-

portant factors in the treatment and prognosis are analyzed. The presence of shock before or during the operation, the presence of gross fecal contamination of the peritoneal cavity and multiplicity of wounds, were found to be of especial importance.

A review of the results of the three principal operative methods of early treatment of wounds of the colon showed that the mortality rate in World War II when exteriorization without resection was employed was 39 per cent when suture plus proximal colostomy was employed the rate was 37 per cent when suture alone was used the rate was 22 per cent. Usually the procedure of choice in wounds of the colon is exteri-

## RÉSUMÉ: 70 CASES OF INJURY TO THE LARGE INTESTINE; AUTHORS' SERIES—Continued

Case	Part Injured	Clinical History	Time between injury and operation	Pathologic Findings	Operative procedure	Comment
60	Rectum	Injured 2-3-1945. Operated 2-3-1945, 945	30	Fracture, coccyx; perforation on 12 diameter extraperitoneal rectum.	Sigmoid loop colectomy. Perineal wound debrided. Coccygostomy.	Evacuated 2-3-1945; doing well.
61	Rectum	Injured 3-10-1945		Perforation, on diameter rectum, just above anus.	Perineal wound debrided. Sigmoid loop colectomy.	Evacuated 3-17-1945. In good condition.
62	Rectum	Injured 3-2-1945. Fracture, sacrum.	33	Perforation, anterior postero-lateral, extraperitoneal part of rectum.	Colostomy (sigmoid) loop colectomy. Sigmoid wound debrided, retrorectal incision drained.	Suprapubic cystostomy required because patient unable to void. Evacuated 6-3-1945 in good condition.
63	Rectum	Injured 4-1-44. Perforating gunshot wound entered left buttock, exited left groin.	4	Compacted comminuted fracture, pelvis, sacrum. Abdominal cavity found muscle of rectal wall, but perforation rate because of rectum not proved.	Sigmoidectomy. Sigmoid loop colectomy.	Evacuated 4-13-1945. On 7-13-1945, perineal wound was almost healed, colon at anus still in use.
64	Rectum	Injured 5-7-1945		Sigmoidectomy showed small area of extension of fresh blood coming from rectum, ground colon, but no hole seen in wall of colon. Extraperitoneal hemorrhage along anterior wall of rectum and retroperitoneal colon. Compacted comminuted fracture, iliac.	Sigmoid loop colectomy. Perineal wound debrided.	Evacuated 5-22-1945.
65	Rectum	Injured 5-4-44	21	Retrorectal contusion, posterior wall rectum appeared sufficiently contained to warrant colectomy.	Rectum mobilized; shell fracture repaired. Sigmoid loop colectomy. Perineal wound debrided.	Anterior of lower left, left 1 1/2 developed patient very ill, about 3 inches of sigmoid colon herniated through colectomy wound. Evacuated about 24 post-operative day in good condition.
66	Rectum	Injured 5-3-1944. Multiple wounds (shell fragments).		Rectosigmoid perforated, as well as muscle laceration in transverse colon, but no perforation. Jejunum perforated; jejunum divided. One intraperitoneal, one extraperitoneal perforation, moderate size, in bladder. Severe penetrating wound, left femoral region, compound comminuted fracture of skull.	Perforations in intestines and bladder repaired. Ligated a transverse T point of divided jejunum. Transverse loop colectomy. Catheter inserted in bladder allowed to empty through lower part of abdominal incision. Wound debrided in situ; distal defect repaired with pedicled patch.	Anterior of left lower lobe perforated, became dyspneic, cyanotic. Died on 14th post-operative day. Autopsy: very bad damage thought to be main cause of death. Also observed perforation, perforation left lower lobe of lung, multiple small abscesses of that lobe.
67	Rectum	Injured 5-20-1945. Admitted in severe shock, poisoning, without perceptible blood pressure. Rapid exd. 140 m. Wound in left buttock. During 30 hours preceding operation patient received 1000 cc. whole blood. Later blood pressure 72/60. (Thought to be hemorrhage, peritonitis were present).	34			Patient died during induction. Colostomy performed quickly because hemorrhage, if present, and to permit massage of heart. It was no vital. About 1000 cc. of fresh blood in peritoneal cavity generalized peritonitis. Large hole, anterior aspect of rectum, and laceration posterior to the peritoneal reduction. Frequent perforations in ileum. Large retroperitoneal pelvic hematoma.
68	Rectum	Injured 5-27-1944		Tear, 3 cm long in rectum. Great fecal contamination. Sigmoid perforated 3 times, bladder torn.	Sigmoid wound debrided. Colostomy. Rectal, bladder perforations sutured. Sigmoid loop colectomy. Suprapubic cystostomy. Two feet of distal ileum resected.	Patient died 27 hours after operation. Death believed due to traumatic, operative shock, exaggerated by great fecal contamination.

## RÉSUMÉ 70 CASES OF INJURY TO THE LARGE INTESTINE AUTHORS SERIES—Continued

Case	Part injured	Clinical history	Hours between injury and operation	Pathologic findings	Operative procedure	Comment
69	Rectum	I Jured. 10-3 1944.	2	One perforation on each lateral wall of rectum, both retroperitoneal, 1 cm diameter. Marked retroperitoneal hemorrhage about rectum sigmoid bladder Gas, 1 measure amounts, extended retr. perito easily from rectum up along descending colon, into sigmoid mesentery. Compound fractures, left humerus, left femur	Celiotomy Transverse loop colostomy. Buttock wound debrided; drain inserted down to rectum. Nothing done to remaining wounds because surgeon felt patient would not tolerate further surgery. C. dist. remained poor and on the second postoperative day gas gangrene detected in left arm amputated, lower extremity wounds debrided. Patient dist. was poor during procedure; rem. ill 41 hours; died shortly afterward	A topey subcutaneous crepitation, whole left hemithorax, but muscle section taken from boulder showed no evidence of electrical myositis. Pathologist: "Severe fat pulmonary embolism, so severe that it was probably the immediate cause of death. Moderate number renal fat emboli. Death due to combination traumatic and operative shock, gas gangrene pulmonary fat embolism."
70	Rectum	I Jured. 5 4 1945	5	Perforating gunshot wound entrance above symphysis pubis; exit left buttock. Severe hemorrhage region of hypogastric vein. Two intraperitoneal perforations in rectum, three 1 distal ileum. Gross fecal material, incompletely digested food (small bowel contents) in peritoneal cavity	Celiotomy Bleeding vessels ligated. Perforation in intestines closed. Sigmoid loop colostomy. Left buttock wound debrided.	Second day postoperatively 2000 cc. urine from fluid evacuated from peritoneal cavity. Catheter left in situ; drained approximately 1700 cc. a day. Cystoscopy 7 days after operation. Suprapubic catheter inserted 3 days after operation. fecal fistula developed about suprapubic catheter. Next day severe hemorrhage through abdominal wound. Patient went into severe shock; was operated on. One perforation in rectum had reopened was resected. Fecal material collected in dish reg. through abdominal wound. Patient died 16 days after injury. Autopsy: 5 cm. perforation in distal ileum just opposite short suture line 1 gut. from this hole feces were extruding. Fecal matter could be expressed from one of rectal suture lines. Two perforations, each about 5 mm. diameter, found in intraperitoneal part of bladder. Generalized fibrinopurulent peritonitis. Death due to peritonitis, which developed as result of missing two small intraperitoneal holes in bladder. First operation.

Case 64 cannot be classified exactly. The patient had some blood in the area of the rectosigmoid as seen at proctoscopy before the operation. No perforation was found. At celiotomy there was hemorrhage about the rectosigmoid. In any case such as this one in which damage is suspected even though not proved we think colostomy should be done.

## SUMMARY AND CONCLUSIONS

Seventy cases of injury to the colon and rectum in which the patients were treated in an evacuation hospital with a mortality rate of 27 per cent are presented. The literature is reviewed. Im-

portant factors in the treatment and prognosis are analyzed. The presence of shock before or during the operation, the presence of gross fecal contamination of the peritoneal cavity and multiplicity of wounds were found to be of especial importance.

A review of the results of the three principal operative methods of early treatment of wounds of the colon showed that the mortality rate in World War II when exteriorization without resection was employed was 39 per cent when suture plus proximal colostomy was employed the rate was 37 per cent when suture alone was used the rate was 22 per cent. Usually the procedure of choice in wounds of the colon is exteri-



onization. Suture with performance of proximal colostomy is a sound procedure in some cases. Suture alone has a more limited use. The method chosen should depend on the location and size of the intestinal wound and the condition of the patient. Large, ragged wounds should be exteriorized. Suture alone and suture with proximal colostomy should be used for smaller wounds and for wounds in which more extensive procedures are contraindicated by the general condition of the patient.

Intraperitoneal wounds of the rectum must be sutured and proximal colostomy performed.

Extraperitoneal wounds of the rectum are in a separate category. Wide drainage to the exterior should be established and proximal colostomy should be carried out. When injuries have been treated thus, the mortality rate associated with the injuries has decreased to around 6 per cent, by far the lowest mortality rate associated with wounds in any part of the large intestine.

An analysis of the 70 cases has been arranged according to the anatomic situation of the injury in the colon and rectum. In addition a résumé of the 70 cases is included.

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# ABSTRACTS OF CURRENT LITERATURE

## SURGERY OF THE HEAD AND NECK

### EYE

**Paralysis of Vertically Acting Muscles.** FRANCIS  
HEED ADLER. *Am J Ophth.*, 1948 31 387

In the present article the author discusses some confusing factors in the diagnosis of paralysis of the vertically acting muscles.

Differential diagnosis is difficult because two muscles appear to be paralyzed in cases of paralysis of the vertically acting muscles.

It is pointed out that there are two groups of cases.

Included in the first group are cases in which no single lesion could possibly involve both muscles—the superior rectus of one eye together with the superior oblique of the opposite eye or the inferior rectus of one eye together with the inferior oblique of the opposite eye. In these cases only one muscle is actually paralyzed and the seemingly paralyzed muscle in the opposite eye is underacting on the basis of Hering's law. When the paralyzed eye is habitually used to fix, the effect of a paralysis of one muscle extends to the activities of other muscles in the same eye and in the opposite eye.

The second group consists of cases in which a single lesion affects the elevator or the depressor muscles of one eye or both superior oblique muscles. On anatomic grounds the elevators and depressors of one eye can be caught in the orbit by scars and growing tumors, or the nuclei of origin of their nerves may be damaged by small lesions in the pons. Both fourth cranial nerves may be caught as they cross each other before emerging on the posterior face of the brain stem.

JOSHUA ZUCKERMAN M.D.

**Pathology of Mucous and Salivary Gland Tumors in the Lacrimal Gland and the Relation to Extraorbital Mucous and Salivary Gland Tumors.** ERIC GODTFREDSEN. *Brit J Ophth.* 1948, 32 171

The author discusses the pathology of mucous and salivary gland tumors in the lacrimal gland and their relations to extraorbital mucous and salivary gland tumors. The investigation is based on cases of mixed tumors in the lacrimal gland observed in the Eye Department of Karolinska Sjukhuset Stockholm within the 15 year period from 1932 to 1946. Of 78 cases of orbital tumors 52 were verified as proper tumors 5 were pseudotumors and 21 were not verified. Of 52 orbital tumors 36 were primarily orbital (18 originating in the lacrimal gland, 10 mixed and 8 lymphomatous) 8 were neural from the optic nerve 6 were skeletal 3 vascular and 1 was a dermoid cyst.

Tumors of the lacrimal gland constitute about one-fourth of the comparatively rare orbital tumors.

Histopathologically there are two main types the fibromyxoeplithelioma and the basalloma, both of which may be either benign or malignant. Transitional forms and even different phases may occur within one tumor so that differential diagnosis may be difficult or impossible.

The clinical findings included exophthalmos in 6 cases visual impairment in 3 cases ptosis in 1 case and metastasis to the cervical glands in another.

Although lacrimal gland tumors are superficial and accessible for surgical and radiological treatment the results of treatment are poor. Despite excision with or without irradiation only 5 of the present 10 patients are alive one with recent recurrence the others after fairly short periods of observation. Two of these 5 tumors were histopathologically diagnosed as malignant.

Mixed tumors of the lacrimal gland, previously regarded as histologically and biologically polymorphous tumor forms are now considered morphologically simple and lacrimal gland tumors resemble mucous and salivary gland tumors in other regions. After the clinical diagnosis of lacrimal gland tumor the nature of the tumor should be ascertained by biopsy specimen. Basalloma (which resembles basal cell cancer of the skin) is practically always malignant fibromyxoeplithelioma is usually benign.

Benign tumors should be excised by Kroenlein's operation or by anterior orbitotomy. Malignant tumors should be given preoperative x ray treatment (4,000 to 5,000 roentgens) followed by evisceration of the orbit a month later. Even if the tumor responds favorably to irradiation evisceration should not be omitted.

The more exact the diagnosis the better are the chances of response to treatment, especially if treatment is instituted early.

Godtfredsen emphasizes the histopathologic and biologic parallelism between tumors of the extraorbital mucous and salivary glands and tumors of the lacrimal gland of the mixed type.

JOSHUA ZUCKERMAN M.D.

**The Problem of Sympathetic Ophthalmia.** BYRONARD  
SAMUELS. *Am J Ophth.* 1948 31 397

The author discusses the problem of sympathetic ophthalmia. He points out that in this condition a specific infiltration occurs in the pigmented highly vascular uvea. This consists of three elements lymphocytes, epithelioid cells, and giant cells.

Wounds in the danger zone i.e., over the ciliary body are more serious than wounds elsewhere because prolapse of uveal tissue can occur more readily in this area. The larger the perforation the greater the hazard of prolapse with incarceration.

Sympathetic ophthalmia may also follow operations for glaucoma, but not operations for detachment of the retina. Generally speaking, as long as an eye remains hard after an operation the probability of sympathetic ophthalmia is remote. Cataract extraction and operations for glaucoma are the most common surgical procedures which may result in sympathetic ophthalmia. The following operations are also considered hazardous: iridodonesis, evisceration and repair of iridodialysis.

Indectomy for relief of secondary glaucoma should always be avoided. Paracentesis is the only safe procedure. A complicated cataract which develops in a sympathizing eye should not be removed for many many months.

From 2 to 13 per cent of all cases of sympathetic ophthalmia originate in eyeballs with post-traumatic septic endophthalmitis.

After septic panophthalmitis, the incidence is about 3 per cent.

Retention of an intraocular foreign body results in irritability which may excite irritation of the other eye.

Clinically sympathetic irritation precedes sympathetic inflammation. Irritation is a warning of impending sympathetic ophthalmia. It disappears within a few days after enucleation of the injured eye. Acute inflammation that is sympathetic ophthalmia is manifested in the uninjured eye by a disturbance of vision, pain, fine greyish keratic precipitates, synechias, vitreous opacities, and small yellowish patches in the choroid.

In sympathetic iritis the entire posterior surface of the iris may be agglutinated to the capsule of the lens. In iritis serosa, the pupil is free. In plastic iritis the adhesions are incomplete and confined to the pupillary zone. The presence in the anterior chamber of greyish nodules at the pupillary border extending to the lens capsule, is considered the most significant clinical sign of sympathetic ophthalmia.

It is important to know when to enucleate an injured eye and when not to enucleate it. The injured eye should be enucleated (1) when the fellow eye is irritable even if it be apparently normal, (2) when keratic precipitates appear in the fellow eye (3) when there is a hope of usefulness of the eye and (4) when endophthalmitis is present.

The injured eye should not be enucleated (1) when a wound heals properly the tension is favorable sight is retained, and the fellow eye shows no irritation (2) when the injured eye still has some vision after the fellow eye has become inflamed, (3) when both eyes are violently inflamed, and (4) when panophthalmitis is present. In this case, excision should be postponed until the inflammation has sub-

is pointed out that miotics may increase the tendency to the formation of central synechia and mydriatics may produce glaucoma. Administration of salicylates, mercury, salvarsan, tuberculin, preparations, penicillin, and fever therapy may aid.

JOSEPH A. LINDSEY, M.D.

## EAR

The Repair of the Ear Drum in Blast Injuries.  
SUMMARY HAROLD BARON. *Ann. Otol. Rhinol.* 94:8  
57-143.

The author's experience with blast injuries to the ear were with few exceptions in accord with that reported by others.

Tinnitus and temporary deafness were constant early symptoms. Transient vertigo was often present. Deafness was of the conduction type superimposed upon a temporary perception deafness. Hearing was usually impaired more in those cases in which there was an unruptured drum. In this series of cases the incidence of complicating otitis media was high. It was noted that perforations with infection healed as rapidly as those without infection. The drum membrane healed in some cases even when three-fourths of its total area was destroyed, provided that no part of the perforation reached the sulcus tympanicus. The use of prostheses placed over the perforation increased the incidence of complete healing.

JOHN R. LINDSEY, M.D.

Facial Paralysis in Otology J. BROWN FARRIOR.  
*Semin. W. J.* 94:8, 4 348.

Facial paralysis, the most grotesque complication in otology presents a grave problem, which is a stimulus to every otologic surgeon. The timely and accurate management of facial paralysis will result in maximal recovery and minimal residual deformity whereas delay or inept management will leave a lifelong stigma upon the patient as well as upon the surgeon.

The classic work of Ballance and Ducloux is the foundation of our modern concepts of the otologic management of facial paralysis. The uniformly remarkable success of their experiments on facial nerve grafting provided world-wide stimulus in this field of surgery.

The author gives the following summary:

Intratemporal operations on the facial nerve include simple decompression, decompression and end-to-end anastomosis, decompression rerouting and end-to-end anastomosis, or decompression and nerve grafting.

Facial paralysis resulting from basilar skull fractures may be amenable to otologic surgical treatment if the lesion involves the middle ear. Exploration should be considered when there is loss of response to faradic stimulation.

Facial paralysis developing early in the course of acute otitis media and mastoiditis will usually respond to management of the primary pathologic process.

Facial paralysis occurring during the destructive stage of acute mastoiditis or in chronic mastoiditis demands immediate surgical intervention.

Delayed facial paralysis developing in the post-operative period of any otologic operation should be treated conservatively unless there is loss of response to faradic stimulation.

Immediate facial paralysis developing during any otologic operation demands immediate exploration and should never be treated by hopeful expectancy.

Restoration of the continuity of the facial nerve itself is indicated if the cut ends of the nerve are accessible and the muscles of the face are contractile. Accessible lesions are situated between the geniculate ganglion and the pes anserinus. With restoration of continuity of the facial nerve itself a good result is to be expected. This is the only method which will restore bilaterally co-ordinated emotional facial expression.

The importance of facial paralysis has been greatly overstressed as a possible sequel of the fenestration operation.

Decompression of the facial nerve may be indicated in those cases of Bell's palsy which show loss of response to faradic stimulation for 6 weeks.

The article is illustrated with 4 very good anatomic drawings.

JOHN F. DELIN M.D.

### NOSE AND SINUSES

Plastic Dacryocystorhinostomy (Dacriocystorhinostomia plastica) FERNANDO LINHARES. *Rev. brasil cir.* 1948 17 37

The author reviews the anatomy, histology, and physiology of the lacrimal apparatus and lists rhinogenic causes predisposing to dacryocystitis, such as deviation of the septum, atrophic rhinitis, and nasal polyps. The author presents statistics of 50 cases in which operation was done according to Dutemps technique slightly modified by the author with a high percentage of cures.

Injections of vitamin K and calcium are given during the preoperative period. The operation is performed under regional and local anesthesia. The main step of the operation consists of passing a silk thread without end through the lower lacrimal canal.

JOSEPH K. NARAT M.D.

The Operative Treatment of Ozena. A RÉLÉMI J. *Lar. Old. Lond.* 1948 61 139

The essential feature of ozena is the atrophy of the mucosa, the glands of which undergo destruction. Thus the secretion decreases and becomes thick. On the other hand, the nasal cavity becomes wider and larger, which allows too much air to stream through. Under normal conditions the air becomes warm, clear, and moist while passing through the nose. In ozena the atrophic mucosa is incapable of cleansing and heating the air; simultaneously the air absorbs moisture being unsaturated from the surface of the pharyngeal and laryngeal mucosa. Thus ozena is characterized by a nasal secretion that contains less moisture and becomes sticky, whereas the air in the enlarged cavity is of greater quantity than under normal conditions and poor in vapor. In this way the secretion soon becomes dry. This dry substance is responsible for the factor leading finally to a social inferiority complex in the patients. Further complaints are the frequent headache, anosmia, and

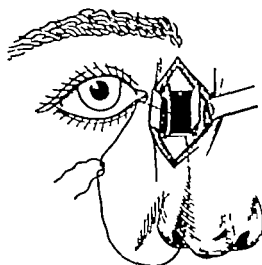


Fig. 1 (Linhares) Passing a silk thread through the lower lacrimal canal.

paresthesia due to engorgement of the nasal meatus by the dry masses in spite of the wide nasal cavity. After some time the pharynx and larynx become dry and catarrhal degeneration of the decomposed secretion gives rise to alterations of the alimentary tract, bad nutrition, and anemia.

Despite the many symptoms, we are completely ignorant as to the real cause of the condition. The theories are interesting but in no way have led to proper treatment.

The operative procedure is described in detail and 5 illustrative figures are presented. It consists essentially in making a mucosal flap of the septum containing both cartilaginous and bony portions. It is freed with considerable technical difficulty and left in situ for 8 days. The object of the second phase of the operation is to push the flap toward the patent side of the nose where it will form a transverse vertical wall occluding about 90 per cent of both meati.

The third phase is carried out between the tenth and fourteenth days and consists of transposing Stensen's duct to either of the maxillary sinuses, but never both.

JOHN F. DELIN M.D.

### MOUTH

Revaluation of the Implantation of Fascial Strips through the Masseter Muscle for Surgical Correction of Facial Paralysis. (Report of 3 Additional Cases). NEAL OWENS. *Ann. Otol. Rhinol.* 1948 57 55

In November 1946 the author presented the technique and results of fascial and muscle transplants for the correction of facial paralysis. In this article he gives the results in the patients and describes the operations on 3 new patients and reoperation in 2 of the cases in the previous series.

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JOHN R. LUDWIG M.D.

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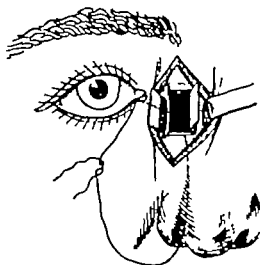


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### MOUTH

**Reevaluation of the Implantation of Fascial Strips through the Masseter Muscle for Surgical Correction of Facial Paralysis.** (Report of 3 Additional Cases) NEAL OWENS. *Ann. Otol. Rhinol.*, 1948, 57 55

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The author believes that the direct attachment of the muscle fasciculi to the paralyzed muscles offers a less satisfactory result than the use of fascial strips which connect the masseter muscle to the paralyzed

one. In this procedure there is less risk of possible injury to the nerve to the masseter muscle, and less danger of loss of muscle tissue due to the secondary infection.

The utilization of fascial strips attached directly to an intact muscle which has normal innervation and carried to the paralyzed muscles furnishes a supportive sling that gives an additional quality of movement upon contraction of the normal muscle. Because of the position innervation, and attachment of the masseter muscle, it is particularly well suited for this purpose.

The author briefly gives some details on the technique of the operation with special strips obtained from the fascia lata.

The fascia should be fixed to the masseter muscle so that it is attached to a point superior to the normal angle of the mouth to assure an upward pull. It is very important not to enter the oral cavity as contamination may result in secondary infection and ruin the end-result.

After the skin incisions have been closed with subcutaneous sutures of nylon and the skin with dermalon oococo, strips of 1 inch gauze are fixed by collodion to the skin to support the face in position.

Postoperatively these supportive strips are respliced as frequently as necessary and the patient is put on a liquid and semisolid diet for the first month. Thereafter he is permitted to contract the muscles, and later he is instructed to practice facial movements.

The author believes that this procedure is indicated when from 1 to 3 years have elapsed since transection of the nerve when direct nerve anastomosis is not feasible when substitution of the spinal accessory or the hypoglossal nerve is not possible or is not desired or when a nerve anastomosis has been attempted previously and failed.

In the author's series the facial paralysis was due to surgical transection in excision of a tumor or the excision of a neuroma acoustica residual permanent paralysis following Bell's palsy infantile paralysis, and unknown causes.

If the fascial strips are utilized, there is little cause to destroy the innervation of the normal muscle and unless the result is impaired by secondary infection, it offers more than static support to the involved side of the face.

The author gives brief case reports of 3 new cases and of 2 cases in which operation had been done previously.

WILLIAM A. ARBROOK, M.D.

### PHARYNX

Acute Polyradiculoneuritis Arising after Peritonsillar Abscess and Accompanied by Increased Antistreptolysin Titer in the Cerebrospinal Liquor. PER FRANK IVERSEN. *Acta med. scand.*, 94:5, 79-441.

The etiology of polyradiculoneuritis is under discussion the disease itself seems no longer so strictly distinguishable from other similar affections as when

Gullain and Barre first described their syndrome. The albuminocytological dissociation and the flaccid paresis are assumed to be due to an infection by most investigators, while others point to allergic and toxic reactions toward different substances as a possible cause. The condition has been seen as a consequence of diphtheria, but in most cases it has not been possible to demonstrate any specific microbe. The theory which seems to be most favored at present is that we are dealing with a virus disease.

The following case history is presented.

A man, aged 42 years, with a history of several peritonsillar abscesses, and who had 3 years previously had a general dermatitis, developed another peritonsillar abscess, and 5 weeks later a flaccid quadriplegia occurred with extinguished tendon and plantar reflexes. He experienced a peripherically increasing loss of sensation. The cerebrospinal fluid showed albuminocytological dissociation. After a fortnight's stay in the hospital increased antistreptolysin titer was noted in the cerebrospinal liquor.

After one month's stay in bed there was considerable improvement in strength and sensation.

When the patient came for control examination 3½ months after the paresis set in, there was good strength in all the groups of muscles, as well as normal sensation and reflexes. The cerebrospinal fluid now gives normal findings as regards cells and protein, and the antistreptolysin titer has gone down to 0.

Acute polyradiculoneuritis often starts with an affection of the upper respiratory tract. In this patient who had previously had several peritonsillar abscesses and was suffering from chronic tonsillitis and laryngitis it was natural to consider his paresis in connection with his infection of the respiratory tract. The microbes most frequently found in peritonsillar abscesses are streptococci. It is a well known fact that the antistreptolysin titer in the blood is increased in most cases of peritonsillar abscess. The author assumed that the disease from which the patient was suffering could be due to a streptococcal infection. The author found an increased antistreptolysin titer in his spinal liquor.

Attention is drawn to the similarity between the acute polyradiculoneuritis in this case and ordinary acute nephritis or rheumatic fever. The latter diseases are as we know generally regarded as allergic reactions to an infection. In the author's case the patient's previous general dermatitis pointed to an allergic disposition.

JOHN F. DILLON, M.D.

### NECK

Present Day Trends in Thyroid Research. J.H. MLEARN. *West J Surg* 94:8, 56-61.

The tempo of thyroid research has increased strikingly principally because of the many new techniques now available. The use of radioactive isotopes of iodine and the employment of new antithyroid agents are perhaps the most prominent of the new techniques. Thyroid research is becoming more fundamental in character and the author

# SURGERY OF THE HEAD AND NECK

believes that the phylogenetic approach would yield important knowledge.

Two hormones are involved in the study of the thyroid the hormone produced by the thyroid gland (TH) and the pituitary hormone which stimulates the thyroid (TSH). The synthesis of the thyroid hormone has been the subject of an extensive amount of investigative work. Thyroxine was first synthesized in the laboratory and this was logically followed by a study of its synthesis *in vivo*. This involves not only the iodination of tyrosine and the condensation of two such molecules to form thyroxine, but the iodide received by the thyroid gland must be oxidized to iodine to be used in this process, and also a protein thyroglobulin must be manufactured to serve as a matrix within the molecule of which the process takes place. This protein also acts as a vehicle for the storage of the hormone in the follicle. Recent work indicates that there may be a specific iodine trapping mechanism in the thyroid. The thyroid gland is not indispensable for the synthesis of iodoprotein and human myxedema has been relieved with mammalian serum protein treated *in vitro* with iodine and artificial thyroprotein has been made by iodinating casein.

Investigation of the control of the thyroid gland is one of the well marked trends of modern thyroid research. Little is known of the sole activity of the thyroid gland. The secretory threshold in the pituitary gland of the thyroid stimulating hormone may be altered by nervous stimuli coming chiefly over the hypothalamic tract and possibly also over the sympathetic pathways to the pituitary situated alongside the blood vessels. The manner in which the thyrotropic hormone affects the thyroid is being subjected to the most active research at present. In acting upon the thyroid cell this hormone becomes inactivated but it can be reactivated by reducing agents. Iodine inactivates it and thiourea reactivates it. The thyroid-stimulating hormone may be concerned in the production of exophthalmos.

F. J. LEEMANN, JR., M.D.

**Calcified Endothoracic Goiter and Median Sternotomy** (Goitre endothoracique calcifié et sternotomie médiane) EMILE DELANNOY *Rev. chir. Par.*, 1947 66 271

The question as to whether a retrosternal goiter should be removed from above or by opening of the thorax is much discussed in the literature. Most authors believe that every endothoracic struma can and should be delivered through the superior aperture of the thorax. If necessary the capsule of the gland is incised and the glandular substance removed piecemeal in order to reduce its volume.

Although the author agrees that in most cases it is possible and safer to develop the goiter by the cervical route he shows that there are rare cases in which this procedure is nearly impossible. These cases include those with unusual hardness or calcification of the gland and extensive adhesions to the pleura or

trachea. Furthermore, the piecemeal removal of the mass is sometimes risky because the control of hemorrhage is difficult and in case of adhesion there is the danger of producing a pneumothorax and mediastinal emphysema.

The author has performed 1200 strumectomies among which there were 15 retrosternal goiters. Fourteen of these were removed from above only. In one case it was necessary to perform a sternotomy. This case, a large calcified retrosternal goiter in a 61-year old woman is reported in detail. The mass involving both lobes of the thyroid was of the consistency of stone and showed extensive calcification. Its weight was 200 gm. and it was adherent to the pleura and trachea. In this case it was necessary to do a median sternotomy down to the third intercostal space.

The author is in favor of median sternotomy rather than lateral thoracotomy with resection of the clavicle. Sternotomy causes less hemorrhage and shock, and the surgeon keeps clear of the internal mammary vessels and the pleura.

WERNER M. SOLMITZ, M.D.

**The Clinical Significance of a Solitary Nodule in the Thyroid Gland** MAYO H. SOLEY, STUART LLOYD-BAY and MORRIS E. DAILEY *West. J. Surg.* 1948, 56 96.

Ninety-six cases of a solitary nodule in the thyroid gland are reported. Twenty-two of the patients had benign neoplasms and 15 had malignant neoplasms. Malignant tumors are more than twice as frequent in males as in females.

In 38 (39.5%) of the patients the solitary tumor was found to be an involutary nodule. A group of acini in an involuting gland enlarges because of excessive colloid formation and compresses the adjacent thyroid tissue which thus becomes atrophic and forms the capsule of the nodule. The small nodule thus formed may increase in size in a number of ways. The original acini may enlarge by epithelial cellular growth. Cyst formation may occur or growth of the thyroid cells between the large acini may occur. The small nodule thus increases in size to form the clinical thyroid tumor.

In 21 of the cases (21.8% of the total) the solitary thyroid tumors were found to be adenomas. These are true neoplasms and may be classified into four groups: embryonal, fetal, simple and colloid. Eight additional cases could not be classified as the histological picture resembled both that of an involuting nodule and that of an adenoma.

Two of the nodules were classified as adenomas with invasion microscopically. They had the characteristic pattern of a benign neoplasm but they were invading the adjacent gland locally. No recurrence has been noted in these 2 cases which have been followed for 5 and 11 years respectively. Two additional cases were classified as malignant adenomas. Microscopically they presented the usual histological characteristics of malignancy but they showed no capsular or vascular invasion. Neither of



the tumors has recurred during a follow-up of 6 and 8 years, respectively.

Eleven cases were classified as carcinomas of the thyroid. These tumors presented all of the histological cellular characteristics of malignancy plus invasion and were classified into three groups: papillary carcinoma, 3 cases; adenocarcinoma, 5 cases; and carcinoma, 3 cases.

In addition 2 of the nodules proved to be simple cysts, one was an intracystic papilloma, and one solitary nodule was due to thyroiditis.

The authors conclude that it is apparent that the incidence of benign tumors (22%) and malignant tumors (16%) among single nodules in the thyroid gland warrants radical resection of these nodules. Unless the diagnosis of carcinoma is clinically certain, resection of the cervical lymph nodes is not indicated. The authors are against simple enucleation of a solitary nodule, but advocate removal of the entire lobe.

F. J. LEEHMAN, JR., M.D.

**Malignant Tumors in Aberrant Lateral Thyroid**  
(Tumori maligni in tiroide laterali aberranti). LUNO  
Piacentini. *Arch. Ital. chir.* 947 69 4 5.

The author presents a case report of malignant aberrant thyroid tissue. A 27 year old female first noted some swelling in the left side of her neck 2 years before she presented herself to the author. She was seen by a doctor who made a diagnosis of tuberculous adenitis and placed her on calcium therapy with no improvement. The swelling kept on increasing in size and was especially large during menstrual periods. She was first seen August 22, 1935 and at this time she had an ovoid mass about the size of a large egg which lay in the left lateral cervical region beneath the sternocleidomastoid muscle. There was no abnormal pulsation; the mass was freely mobile and moved with deglutition. The thyroid gland was normal. The basal metabolism was 8.

The patient was operated upon August 24, 1935. The mass was found in the superior carotid triangle extending beneath the sternomastoid muscle. It was easily enucleated and possessed a very vascular capsule. It was made up of three lobes, soft and rubbery in consistency and of a black slate color. It weighed 28 grams.

In two successive operations, March 21, 1936 and February 18, 1937 respectively, two other similar nodes were removed, one about the size of a nut and the other the size of a pigeon's egg.

Histologic examination revealed a papillary epithelial neoplastic tissue in a cystic glandular matrix of aberrant thyroid tissue.

The patient never had any symptoms or loss of weight. She was last seen in March, 1937 and presented no change. The basal metabolism rate remained the same.

A review of the literature is presented. From 1857 to 1939 48 cases were reported, while from 1939 to 1942 86 cases were reported. The increase is attributed to better diagnosis and exact classification.

The lesion does not present characteristic clinical signs and exact diagnosis is considered difficult. These tumors may occur in any of the triangles of the neck and usually there are multiple nodules. The most frequent form is papillary (66%). There has been one case report of sarcoma (Onufrio 1934). Only malignant forms are considered.

The treatment of choice is surgical removal. X-ray therapy was used a great deal formerly but for one reason or another it is now reserved for only inoperable cases. Extensive dissection and resection of regional lymph nodes are advised. There are usually multiple small cell nests which cannot be seen or palpated and this explains the cause of frequent recurrence as seen in the author's patient.

LOUIS J. FROST, M.D.

**Papillary Adenocarcinoma of the Thyroid Gland, So-Called Lateral Aberrant Thyroid Tumors.**  
B. MARDEN BLACK. *West. J. Surg.* 948 50 34.

The findings in a review of 113 cases of papillary adenocarcinomas of the thyroid gland encountered at the Mayo Clinic in recent years strengthened the belief, held at the clinic for many years, that the lateral cervical papillary tumors are metastatic lesions from a primary papillary adenocarcinoma of the thyroid gland. Conflicting views concerning these tumors, particularly as to whether they are benign or malignant and as to whether there is always a malignant lesion in the thyroid gland in such cases, have led to evident confusion as to the proper management in such cases. Thus, in almost two-thirds of the cases in the small group in which one of the metastatic lesions had been removed at biopsy elsewhere, removal of the primary lesion had not been advised. The evident lack of understanding, generally of the so-called lateral aberrant thyroid tumors, would be dispelled, it seems, if their metastatic nature were widely recognized.

The malignant nature of the primary lesion in the thyroid gland is well illustrated by the fact that a number of local recurrences follow subtotal lobectomy. It can probably be stated definitely that if the papillary adenocarcinoma is larger than a few millimeters in diameter and if it is recognized during operation, a total rather than a subtotal lobectomy should be carried out. In spite of the fact that subsequent operations to remove involved cervical lymph nodes were infrequently not necessary, the author believes that removal of only the involved lymph nodes, generally as a group, is sufficiently radical treatment of the metastatic lesions. Careful examination at stated intervals after the operation to determine whether unremoved lymph nodes have become palpable is, of course, necessary.

In addition to the fact that a primary papillary adenocarcinoma was found in every case in the series, the fact that the primary lesion was always present in the corresponding lobe of the thyroid gland is of importance from the standpoint of treatment. While no contralateral metastatic lesions were observed, involved lymph nodes were

found in the opposite lateral cervical region in 2 cases in which the primary adenocarcinoma involved one lobe and only the isthmus on the opposite side

**Mortality Operative Complications, and Recurrence Frequency in the Surgical Treatment of Thyrotoxicosis.** ARNE BERTILSEN, ERIK CHRISTENSEN, EGON BROU, and PAUL BECKER-CHRISTENSEN. *Acta chir. scand.*, 1947 96 Supp. 133

This article was written primarily to help decide whether the medical or the medicosurgical treatment of thyrotoxicosis has been influenced by the use of thiourea derivatives. The recent results of the surgical treatment of thyrotoxicosis are reviewed. The frequency of recurrences and the frequency of unfortunate direct consequences of operation are investigated. The mortality, the complications occurring during and immediately after the operation, the frequency and course of postoperative paresis of the recurrent nerve and of hypoparathyroidism and also the recurrence frequency along with a short survey of the literature are reviewed.

This material on thyrotoxicosis is from Surgical Clinic C of the Rigshospital and includes 910 operations in the 5 year period from April 1940 to April 1945. It contains 910 cases of thyrotoxicosis. There were 777 females and 133 males the ratio being approximately 6 females to 1 male. There were 35 recurrences in the females and 4 in the males. Of the patients with recurrence only 19 had been operated upon previously at the surgical clinic from which these statistics were taken. There were 835 cases of subtotal thyroidectomy, 23 cases of enucleation of toxic adenoma and 13 cases of enucleation and hemithyroidectomy. It is interesting to note that in all cases the anesthesia was local with novocaine adrenaline injected subcutaneously and subcutaneously behind the sternocleidomastoid muscle and at the superior lateral poles. Resection has been standard during the past few years also in cases of adenoma.

Among these 910 operations for thyrotoxicosis there were 7 deaths. The mortality rate was 0.77 per cent. In 4 of the 6 fatal primary operations the thyrotoxicosis was not fully regulated the basal metabolic rate having been between +45 and +75. In more than half of the cases in this material the operations were performed in stages. The heart complications recognized prior to the operations did not affect the mortality in this material. There were 40 true thyrotoxic crises of which 4 led to death. The mortality in this group of operations for thyrotoxicosis was 0.70 per cent and the mortality among the operations for recurrence in this group was 2.6 per cent.

From the experience obtained the authors believe that it is advisable to exercise restraint in regard to operation in elderly patients and make efforts to induce remission in more or less iodine resistant patients with methimazole therapy alone, or in combination with iodine preparations. In view of the danger of pneumonia it is recommended that

sulfonamide or better penicillin prophylaxis be used in the more severe cases, especially in thyrotoxic crises.

In this group of cases the patients got up on the seventh day after operation and there were only 3 with true thromboembolic complications, two lung infarctions and an isolated slight case of phlebitis in the left lower extremity. The incidence of thromboembolic complications was 0.33 per cent and there was one death due to coronary thrombosis and one due to preoperative cardiac insufficiency with embolism of the extremity. This made 5 cases and a frequency of 0.55 per cent. Asphyxia during and after operation for thyrotoxicosis may be the result of stenosis or a membranous collapse of the trachea, bilateral paresis of the recurrent nerves or compression of the trachea through hemorrhage. There was one true case of membranous collapse in this series. Asphyxia resulting from bilateral paresis of the recurrent nerves occurred in 3 cases. Tracheotomy was performed only once in this material in a patient with a bilateral lesion of the recurrent nerves. Hematoma with incipient asphyxia necessitating reoperation with renewed hemostasis occurred 6 times. In 6 other cases dilatation of the drainage site and expression of the clots were sufficient.

Wound infection occurred in 8 cases. For the definition of tetany the authors require typical carpopedal spasms or other clonic spasms and do not include the slight forms with paresthesia in the fingers combined with slight hypocalcemia or the quite latent tetany. Among these cases there were 9 of tetany following the primary operations and one case of tetany following a recurrent operation. A frequency of 1.02 per cent among the primary operations and of 2.6 per cent among the recurrent operations. The frequency of tetany for the whole group was 1.02 per cent. There were 23 patients who had slight postoperative hypocalcemia, less than 9 mgm per cent, but had no subjective signs of tetany. All of the 10 clinical cases occurred in women as well as 22 of 23 symptomless cases of hypocalcemia. There was no characteristic age distribution. The anatomic pathogenesis of postoperative tetany must be described as not definitely clarified.

Postoperative paresis of the recurrent nerves occurred in 64 patients with a total of 66 pareses, 18 permanent and 48 transitory. Of the transitory pareses, 19 were on the right side and 27 on the left. No case of permanent paresis ever subsided after a period of 6 months. All the permanent pareses were unilateral. Among 835 cases of subtotal thyroidectomy only 1.3 per cent developed permanent paresis. The highest percentage of permanent paresis (15.4%) occurred following the recurrent operations. Of the total material of 66 cases of pareses 48 or 72 per cent disappeared completely. Among this group there were no cases of permanent bilateral paralysis. During the past 6 months the authors employed laryngoscopy during the operation or immediately prior to closing the wound and if a cord was found to be paralyzed the operative wound was reopened.

and the nerves were freed. In the cases in which the nerves were freed the patients were completely cured. In this method they have found the possibility of reducing still more the frequency of permanent injury to the recurrent nerve. Among 647 patients suffering from thyrotoxicosis, 32 (4.9%) proved to have recurrences, while the patients with exophthalmic goiter numbered 25, or 6.3 per cent. There were 7 (2.8%) with thyrotoxic adenoma. It is interesting to note the interval between the first operation and the onset of recurrent symptoms: 9 patients had a second operation in less than one year, 9 between 1 and 2 years, 8 between 2 and 3 years, 3 between 4 and 5 years, and 4 in more than 5 years. The authors cannot even say in advance which cases are particularly disposed to recur. There is scarcely any doubt that recurrences belong to the special indication sphere of the antithyroid substances or of radioactive iodine. It is suggested that careful attention to the way of life of the patients during the first 3 years after a thyroidectomy may be of importance in preventing a recurrence, and the opinion is expressed that in this period women should avoid pregnancy. Thyrotoxic crisis with a poor general condition and a pulse rate of over 140 occurred in 40 cases, 4 of them terminated fatally in spite of vigorous iodine therapy.

There were 167 patients admitted to this department in the 3 years from April 1945 to April 1947 and 164 operations were performed; there were 151 cases of diffuse hyperplastic goiter, 6 cases of thyrotoxic adenoma, and 10 cases of recurrence. There were 154 subtotal thyroidectomies, and 3 enucleations of toxic adenoma, and 8 resections of recurrent goiter. The authors still prefer local anesthesia for almost all thyroid operations. There were no postoperative deaths. No cases of thrombosis or embolic complications, of tetany or hypocalcemia and no cases of asphyxia occurred. True postoperative crisis with a pulse rate of over 40 occurred in 6 cases but in all cases a normal condition was restored by the intravenous administration of iodine, and the administration of sedatives. The routine postoperative administration of iodine, an antipyretic, and one liter of saline solution parenterally seems to play an important role in the prevention of this complication, which was previously very much feared. While the drugs of the thiouracil group used preoperatively are of immense value in reducing the postoperative crisis, they are of no use at all in manifest postoperative thyrotoxic crisis, because their action is too slow. Among 164 operations for thyrotoxicosis 5 cases of paresis of the recurrent laryngeal nerve occurred. None

drugs alone is still on trial. Most promising preliminary results have been reported with the use of propylthiouracil. RICHARD J. BURGESS JR., M.D.

**An Evaluation of Routine Exposure of the Recurrent Nerve during Thyroid Operations.** RICHARD B. CATTELL. *West. J. Surg.* 1948, 56: 77

In the earlier experience at the Lacey Clinic it was found that unilateral nerve injury occurred in 3 per cent of all thyroid operations, and in recurrent cases this rose to as high as 14 per cent. Following the routine exposure of the recurrent laryngeal nerves the incidence of injury has dropped to 0.7 per cent in 4,793 thyroidectomies. In the operative technique used the prethyroid muscles are divided, the inferior thyroid artery is exposed and usually ligated in continuity, and the recurrent laryngeal nerve is identified. The nerve is most frequently injured either at the inferior pole or at its point of entry into the inferior pharyngeal constrictor fibers. The author does not believe that paralysis follows the gentle handling of the nerve incident to its exposure.

Approximately 3 per cent of injuries of the recurrent nerves result in temporary paralysis only and in such cases some motion will be found within from 4 to 6 weeks. Among 750 cases prepared with thiouracil-like drugs and in which this technique was used injuries were observed in 0.9 per cent. Approximately 3 per cent of the patients will have recurrent symptoms of hyperthyroidism following subtotal thyroidectomy. F. J. LUDMANN, JR., M.D.

**Laryngocoele.** CHEVALIER L. JACKSON. *Laryngoscope* 1947 57: 788.

A laryngocoele is an anomalous air sac connected with the larynx which is in reality a hernia of the larynx, is lined with mucosa, and is not a tumor. While rare in occurrence, it is often overlooked. Any thing that increases the intralaryngeal pressure, such as coughing, singing, blowing a horn, may be of etiological significance. Papillomas, cancer or syphilis may be associated with this condition. Laryngocoeles may be of the internal or external type. The external type is outside of the thyrohyoid membrane and is seen as a bulge in the neck, the internal type is located inside the thyroid cartilage.

Hoarseness is the most important symptom. Dyspnea may be present, an external bulge may be seen, or a hissing sound may be audible when pressure is made on the external bulge. Plainographic x-ray studies in the establishment of the diagnosis.

**Bilateral Granuloma of the Larynx following Endotracheal Anesthesia** J W McLAURIN *Laryngoscope* 1947 57 796.

A case is reported in which a granuloma of the larynx resulted from endotracheal intubation. This is a rare complication being the sixth reported case. Apparently the granulomas originate in a traumatic ulcer of the cord which upon healing slowly from the periphery results eventually in a pedunculated lesion. The lesion should not be removed until it has become pedunculated when its removal is easy and healing rapidly occurs. F J LEBEMANN JR. M.D.

**The Surgical Treatment of Carcinoma of the Hypopharynx and the Esophagus** HAROLD WOOLLEY *Brit J Surg.* 1948, 35 249.

Methods for the removal of malignant lesions of the hypopharynx and esophagus are described together with methods of reconstruction of the continuity in this well illustrated article. Most malignancies of the esophagus and pharynx are epidermoid carcinomas. The subject is divided into 3 parts (1) lesions involving the hypopharynx and the upper end of the esophagus (2) lesions occurring in the mid-portion of the esophagus and (3) carcinomas of the lower portion of the esophagus.

Carcinoma of the retrocricoid area of the hypopharynx is almost entirely confined to the female although about 80 per cent of the carcinomas of the esophagus occurs in men. In addition to x ray studies esophagoscopy should be performed in those who complain of discomfort in swallowing for lesions of the hypopharynx often do not visualize with the barium swallow. Metastases are found most frequently in cases involving the lower third of the esophagus and the more highly differentiated tumors seem to offer the best prognosis.

Operation of the hypopharynx and the upper esophagus should not be undertaken in advanced cases or those in which metastatic nodes are present. Sacrifice of the larynx is necessary in lesions occurring in the pyriform fossa or anterior wall of the pharynx

involving the back of the larynx. After the establishment of an adequate collateral circulation to skin tubes fashioned at the time of the excision of the lesion, the patient may take liquids by mouth. Lesions involving the retrocricoid area do not necessitate laryngectomy although tracheotomy is deemed advisable to combat postoperative laryngeal edema for a few days. Skin tubes are planned at the time of the original surgery in a similar manner to those for lesions in the pyriform fossa.

Because of the high incidence of intra abdominal metastases occurring in lesions of the intrathoracic esophagus the author believes that laparotomy is desirable and that a temporary jejunostomy should be performed in the cases selected for resection. Through a left thoracotomy the esophagus is mobilized. After the diaphragm is incised, the stomach is mobilized along both curvatures and freed from the spleen. The right phrenic nerve is crushed to paralyze the diaphragm. Inversion of the lower end of the esophagus into the stomach is performed after division of the esophagus. The stomach is brought into the left thorax and anchored as high as possible to the parietal pleura preceding anastomosis between the esophagus well proximal to the tumor and stomach. The jejunostomy tube is used to feed the patient postoperatively starting after 72 hours. Fluids by mouth are usually tolerated by the end of the second week at which time the jejunostomy tube is removed.

A combined thoracoabdominal incision is made for removal of lesions of the lower end of the esophagus after preliminary exploration of the peritoneal cavity through the abdominal portion of the incision. Anastomosis between the stomach and the esophagus is done within the thoracic cavity. Following the resection and anastomosis a jejunostomy is performed before closure of the wound. Endotracheal anesthesia with positive pressure control of respiration is used and thoracotomy wounds are drained by a closed system. Emphasis is placed on the careful selection of cases in which the diagnosis of carcinoma has been made reasonably early. JONN L. BELL, M.D.

# SURGERY OF THE NERVOUS SYSTEM

## BRAIN AND ITS COVERINGS; CRANIAL NERVES

The Connections of the Frontal Lobes of the Brain.  
W. E. LE GROS CLARK. *Lancet*, Lond. 1948, 1: 353.

In recent years the increasing therapeutic use of prefrontal leucotomy has directed attention far more closely to the functions of the frontal lobes and has provided much material for their elucidation. The functions of the frontal lobes as of all other parts of the brain, must depend ultimately on their anatomical connections and a review of these will therefore be an important preliminary to physiological and psychological studies.

The frontal cortex is commonly regarded as primarily an association area, that is, a cortical area predominantly concerned with the reception of impulses which pour into it from other regions of the cerebral cortex. This conception, according to the author, has no sound anatomical basis, for there is no evidence of the existence of massive long association tracts streaming forward into the frontal lobe from all the other regions of the cerebral cortex. It also obscures the fact that much of the frontal cortex is an efferent projection area comparable with the visual or auditory areas of the cortex.

A large proportion of the frontal cortex is a projection area for the dorsomedial nucleus of the thalamus, the medial nucleus of human anatomical terminology. According to Mettler (1947) the dorsomedial nucleus connects with all the areas from 8 to 3 in the frontal lobe of the monkey the fibers going to these areas approximately in order from the caudolateral part of the nucleus to the anteromedial part.

The nature of the impulses conveyed to the frontal areas of the cortex from the dorsomedial nucleus can as yet hardly be defined in detail from the purely functional point of view but it is now possible to state with confidence that the dorsomedial nucleus is essentially a relay station for the transmission of impulses originating in the hypothalamus. More recently this connection has been established by studying the effect of hypothalamic stimulation on action potentials in the cortex. Thus there are clearly functional pathways from the hypothalamus to the cortex via the dorsomedial nucleus, and direct efferent connections from the cortex to the hypothalamus.

It may be inferred from these anatomical data that the impulses which stream into the frontal lobes from the dorsomedial nucleus represent the resultant not only of the activities of the hypothalamus but also of some of the activities of the thalamus proper. The frontal cortex also receives hypothalamic stimuli from another source by way of the anterior nucleus of the thalamus. This nucleus is known, from experimental work on lower animals,

to project on to the limbic areas in the cingulate gyrus (areas 24 and 23). Until more is known of the connections and functions of the hippocampus, the significance of the projection from the anterior nucleus of the thalamus to areas 24 and 23 must remain in doubt.

From what has been said, one fact which stands out very strongly is that, by way of the anterior and dorsomedial nuclei of the thalamus, the greater part of the cortex of the frontal lobe must be regarded as a projection area receiving the products of activity of the hypothalamus, in the same way that the visual cortex is the projection area for retinal activities, or the auditory cortex for cochlear activities. In the case of the anterior limbic areas, the hypothalamic connection serves mainly as a relay station for the hippocampus.

The author next considers the intercortical connections of the frontal lobes, that is the association fiber systems which link its different cortical areas with other cortical areas of the cerebral hemisphere. So far as afferent association-fiber systems are concerned, connections to area 8 from area 6 have been established and probably similar short interconnections exist between other frontal areas. As regards long association tracts, connections have been described in the monkey's brain conducting in a forward direction from area 8 of the occipital cortex to area 8.

One of the long association tracts which exist in the cerebral hemisphere has its origin in area 8 of the frontal lobe, the area which is included in the "frontal eye field." This fasciculus passes backward and extends directly to the parastriate area (area 18) surrounding the visual cortex of the occipital lobe. Another efferent association tract from the frontal lobe takes origin from area 47 (area orbitalis agranularis) and curves downward and backward as the uncinate fasciculus to reach area 38 in the pole of the temporal lobe. Degeneration in the uncinate fasciculus has been reported by Meyer et al. (1947) in their series of leucotomized human brains.

The efferent connections of the frontal lobes with subcortical centers may be divided into corticostriate, corticothalamic, and corticohypothalamic connections, and descending connections with the brain stem. The corticostriate fibers originate in the two suppressor areas of the frontal cortex, areas 8 and 44, and terminate in the caudate nucleus (Garol and McCulloch 1944). The corticothalamic fibers from the frontal areas descend to the dorsomedial nucleus. The corticohypothalamic fibers have been studied by Ward and McCulloch (1947) by the method of physiological neuroanatomy. These studies appear to demonstrate that rather specific descending connections exist between different areas of the frontal cortex (and area 64) and different nuclear elements of the hypothalamus particularly the supra-optic and paraventricular nuclei, the lateral and

posterior hypothalamic areas, and the mammillary body. The connections with the paraventricular and supraoptic nuclei are of special significance, for the supraoptic nuclei are known to be connected functionally with the posterior lobe of the pituitary gland by tracts of unmyelinated fibers which descend through the infundibular or pituitary stalk.

HOWARD H. LANDER, M D

Apoplexy N. C. GILBERT and GEZA DE TAKATS. *J Am M Ass.*, 1948 136 659

Because of the remarkable stability of the cerebral circulation it is generally accepted that the neurovascular mechanism of the brain is weak. However many transient cerebral disturbances and symptoms cannot be explained except on a vasomotor basis. Vasoconstriction of the cortical vessels and other circulatory disturbances have been demonstrated experimentally in the presence of emboli and cerebral infarction.

The authors have adopted a more active method of treating patients who have undergone cerebral vascular accidents. Apoplexy was differentiated as cerebral hemorrhage, thrombosis, and embolism. The criteria applied for the diagnosis of these three conditions are fully explained and discussed in the original article.

Twenty five patients, 3 of whom had suffered hemorrhage, 12 a thrombosis and 10 an embolism, were treated with cervical sympathetic block. Good responses were noticed in 19 patients, 7 died and 2 showed no improvement. The best responses were obtained in the patients who were treated for embolism. The 3 patients who had suffered of hemorrhage died.

The injections were performed in the region of the stellate ganglion on the affected cerebral side and within the first few hours of the cerebrovascular accident. The improvements were attributed to the block only if they followed immediately the appearance of Horner's syndrome. The duration of improvement varied from a few hours to several days and were maintained in some cases by repeated injections. The most significant improvements were the conversion of flaccid paralysis into spastic paralysis, amelioration of motor and speech functions and regain of consciousness.

As a result of their experience the authors suggest the following therapeutic measures in acute cerebrovascular accidents: (1) in cases of cerebral embolism the oxygen tent slowing of rapid fibrillation stellate block and the administration of anticoagulants (2) in cases of cerebral thrombosis oxygen tent, venesection when hypertension is present stellate block and release of increased spinal fluid pressure (3) in cases of cerebral hemorrhage oxygen tent slow spinal drainage and possible surgical evacuation of clots. In all three types of accidents the intravenous administration of hypertonic sucrose or concentrated albumin solution combined with aminophyllin is given to combat cerebral edema.

GEORGE PERRET, M.D.

Notes on the Pathology of Cranial Tumors. Tumors Originating in the Marrow of the Diploe. CYRIL B. COURVILLE. *Bull Los Angeles Neur Soc.*, 1948, 13 19.

This article is one of a series which the author has written on various types of tumors of the cranium. The tumors under consideration here—those of the red marrow of the cranial diploe—are varied in nature, never common and in some instances they are quite rare.

There are three general types of such intradiploic tumors: (1) interstitial tumors (fibroma, myxoma, and fibromyxoma) which are quite rare; (2) tumors arising from the hemopoietic parenchyma (myeloma, myeloblastic sarcoma, and chloroma), and (3) a group of doubtful origin, such as Hodgkin's disease (lymphogranuloma) and xanthoma. Another tumor now known as Ewing's tumor or reticulosarcoma is usually metastatic, and is only rarely found to be primary in the bones of the calvarium. Multiple myelomas are among the more common tumors in this general family of neoplasms and they may be of the plasma cell or giant cell type. Myeloblastic sarcomas are rare. They are osteoclastic in behavior. Chloromas are a local manifestation of leukemia, and they are usually rapidly fatal. Of course, there is much argument as to whether Hodgkin's disease is a true tumor or not. Xanthomatosis is an unusual disease, occurring most commonly in children and no doubt represents the involvement of the reticuloendothelial system in a disorder of fat metabolism. It is usually accompanied by a triad of symptoms: diabetes insipidus, circumscribed destruction of the flat bones, and exophthalmos indicative of an involvement of all the bones of the skull.

In any of these diploic tumors surgery is usually not very effective. Radiotherapy sometimes exerts a staying action on their progress.

JOHN MARTIN, M D

Angiomas of the Cranial Vault. Report of Cases with Some Remarks as to Their Pathology and Surgical Treatment. CYRIL B. COURVILLE, PHILIP J. VOGLER, and A. J. MURIELLETTA, JR. *Bull Los Angeles Neur Soc.* 1948, 13 1.

The authors point out that angiomas of the skull (usually occurring in the vault and rarely in the petrous portion of the temporal bone) are but one member of a large family of tumors of angio-blastic origin about the head (angioendotheliomas, angio-blastic meningiomas, hemangioblastomas) and that they are sufficiently individual and common in nature to warrant special classification. They have their genesis in vasoformative cells which for some reason assume a neoplastic urge, and while they grow at various rates of speed, they are usually considered benign. A local palpable bulge of the cranium is commonly seen, and the roentgenograms will show a thickening of the skull as if the two plates were ballooned apart by an area of tissue only partially calcified and filled with calcific striae. Histologically these tumors consist of a connective tissue stroma in which

many newly formed blood vessels are present. These vessels may be either cavernous or capillary in nature. In the masses of proliferating cells, vacuoles appear which on coalescence form irregular cavities. If the cavities remain large, then a cavernous type of angioma results. If a well defined endothelial lining is formed before coalescence of the spaces takes place, it seems that actual capillaries form.

The authors have collected brief information on 43 instances of such tumor from the literature. They report in some detail the data concerning such a tumor discovered incidentally at the autopsy of one of their patients. They suggest that although the tumors usually do not produce any readily recognized signs or symptoms in the patient it is probably the best surgical judgment to remove them even when they are found inadvertently. The color photograph of the specimen was especially interesting.

JOHN MARTIN, M.D.

**Gram-Negative Meningitis following Head Wounds.**  
WALPOLE LEWIS. *Brit J Surg* 94:35 266

An opportunity arose to study the effects of gram-negative organisms in war wounds of the head and spine mainly because of the widespread use of penicillin and the sulfonamides to control infection from gram-positive bacteria. Twenty cases of meningitis caused by gram-negative organisms, especially the *Bacillus coli* are presented as they occurred in 632 head and 160 spinal wounds from Northwest Europe in 1944 and 1945. All wounds were penetrating, and when the dura mater was intact no instance of gram-negative meningitis occurred.

In the series 8 cases were due to the *Bacillus coli*, 3 to the *Pseudomonas pyocyaneus* and 9 to coliform bacilli and Gram-positive organisms. In *Pyocyaneus* meningitis the mortality rate was 100 per cent, and in the others the mortality rate was approximately 50 per cent. A major factor in the recovery of 4 cases was thought to be due to surgical removal of retained foreign bodies and necrotic material. *Coliform* bacilli were usually found early after injury whereas *Pseudomonas pyocyaneus* was a late invader and was usually secondarily introduced.

Case histories, laboratory data, and statistical charts are given in the text. Although streptomycin was not freely available at the time of the clinical study its use in treatment is mentioned in the discussion. The importance of adequate surgical care of penetrating head wounds from the onset is stressed. Considerable space in the discussion is given to the importance of preventing and treating subarachnoid block in pyogenic meningitis. JOHN L. BELL, M.D.

**Major Trigeminal Neuralgia.** EDWARD W. DAVIS and HOWARD C. NARRON. *California M* 94:3, 68 130.

The authors present a statistical analysis of 245 cases of trigeminal neuralgia. The disease had its greatest incidence in the sixth decade. It occurred twice as frequently among females as in males. The right side was involved in 179 cases as compared to

75 cases for the left, but 9 patients had bilateral involvement. The average duration of symptoms before the patients were seen by the authors was 7 years. The pain rarely began in the ophthalmic division. It had its onset in the mandibular and maxillary divisions in equal frequency and often spread to involve adjacent divisions.

Patients describe the pain with striking similarity using such words as "jabbing, cutting, burning, lightninglike or electric-shock-like." Nearly all state that it begins and stops suddenly. There are usually complete remissions of pain of from months to years.

Most patients indicate definite trigger zones, the most common being the lips, gums, nasolabial fold, ala of the nose and the chin. The patients take great care when they laugh, talk, eat, brush their teeth, or wash their face.

Forty-four patients noted residual soreness after or between attacks. Of these 23 had residual soreness for only a short time after the usual lancinating sharp pain, but were relieved by sensory root section or alcohol injection. The remaining 20 had constant pain interspersed with sharp pains but all except one of these responded to treatment. This patient was relieved of the sharp lancinating pain, but the dull constant ache remained.

One hundred and seventy-five patients received alcohol injections. The average alcohol injection was effective for from 6 to 14 months the longest period of relief being 7 years. Neurectomies were done in 3 patients and the results were similar to those following alcohol injections. Sensory root sections by means of the subtemporal approach were done in 179 patients, most of whom had previously had either an alcohol injection or a neurectomy. There were 3 deaths following root section. Thirty-two patients had a temporary facial palsy following root section. When partial section of the root was done, pain appeared later in the area innervated by the undivided portion and required reoperation in 6 of the cases.

Forty-eight patients were given trichlorethylene. Half of them received from partial to complete relief. The inference is made that this method has its chief usefulness in the very old patients who are considered poor operative risks and in whom alcohol injections have been unsuccessful.

The authors conclude that the procedure of choice is a differential section of the sensory root with sparing of the motor root.

DANIEL REAR, M.D.

**Glossopharyngeal Neuralgia: A Cause of Cardiac Arrest.** B. GUNSON S. RAY and HAROLD J. STEWART. *Am. Heart J* 94:3, 35 458.

Glossopharyngeal neuralgia is a disease which may at times be associated with cardiac arrest, as first reported by Riley and his associates in 1913. The authors call attention to this syndrome, which originates through the carotid sinus reflex. The excessive stimuli to the sinus reflex result from the afferent pathway of the carotid sinus reflex through the glossopharyngeal nerve.

A case is reported of a 40 year old male with characteristic glossopharyngeal pain. With severe attacks cardiac arrest resulted, the blood pressure fell and the patient became pale, lost visual fixation showed signs of confusion and occasionally had complete syncope.

The glossopharyngeal nerve was divided intracranially, which afforded relief from the neuralgia and abolished the episodes of cardiac arrest and syncope.

HOWARD A. BROWN, M.D.

**The Role of the Glossopharyngeal Nerve in the Carotid Sinus Reflex in Man; Relief of Carotid Sinus Syndrome by Intracranial Section of the Glossopharyngeal Nerve** BROWSON S. RAY and HAROLD J. STEWART *Surgery* 1948 23 411

Denervation of the walls of the carotid sinus and of the Y of the common carotid bifurcation has been commonly practiced for relief of the hypersensitive carotid sinus. This operation has met with a fair degree of success but often fails to give relief because of local nerve regeneration or incomplete removal of all the afferent nerve connections.

The four nerves which contribute to the innervation of the carotid sinus and adjacent carotid body are the glossopharyngeal, vagus, cervical sympathetic, and hypoglossal nerves. The glossopharyngeal connections of the carotid sinus nerve transmit the bulk of the cardiovascular components of the sinus reflex in the dog and Bucy raised the question as to the possibility of altering the systemic blood pressure in humans by intracranial section of the glossopharyngeal nerve.

Most observers believe that the carotid sinuses and the aortic arch with their associated carotid and aortic bodies exert a major regulating influence on the central cardiovascular and respiratory control. Stimulation of the sinus by chemical means by increased pressure from within or by direct pressure from without, causes the heart rate to slow, the blood pressure to fall and respirations to increase at least until compensated for by other mechanisms.

The syndrome of carotid sinus syncope is well established. Three types of the syndrome have been described: (1) the 'vagal type' resulting from cerebral anoxia due to reflex cardiac astyole, (2) the 'depressor type' resulting from cerebral anoxia due to a fall in systemic blood pressure alone, and (3) the cerebral type in which syncope ensues without marked change in cardiac rate or in blood pressure.

Bucy reports 4 cases and Ray reports 15 in which a temporary rise in blood pressure and cardiac rate followed intracranial division of the glossopharyngeal nerve for relief of pain. In most of the patients the return of blood pressure and cardiac rate to preoperative levels occurred in a few days as the result of compensation, notably the contralateral carotid sinus reflex.

One unusual syndrome linking the glossopharyngeal nerve to the carotid sinus reflex is reported—a combined glossopharyngeal tic douloureux and cardiac arrest. In the syndrome, paroxysms of pain in

the region supplied by the glossopharyngeal nerve was accompanied with cardiac slowing or arrest and a fall in blood pressure, and sometimes syncope. Intracranial division of the glossopharyngeal nerve abolishes the entire syndrome.

Ray reports 3 cases in which the ninth nerve was divided intracranially on one side for relief of the carotid sinus syndrome. Two of these patients obtained marked relief of the former attacks of syncope (now 5 years and 3½ years since the operations were performed). Special preoperative tests consisted of pressure over the carotid sinuses with resultant carotid sinus syndrome effects, notably from the hypersensitive side, and procainization of the hypersensitive sinus followed by pressure with resultant loss of hypersensitivity.

Postoperatively pressure over the carotid sinus on the side of the nerve section caused no alteration in cardiac rate, blood pressure or respirations; there is no loss of consciousness as long as pressure does not occlude the internal carotid artery. The carotid sinus on the unoperated side possessed the same degree of sensitivity as that which existed preoperatively.

In one case, intracranial division of the glossopharyngeal nerve on one side and anesthetization of the opposite carotid sinus with procaine sodium cyanide evoked a respiratory reaction in the same time interval from injection as in the control cases with intact sinus mechanisms, thereby raising the question as to whether the chemically induced portion of the carotid sinus reflexes traverse pathways other than the ninth nerve.

The intracranial division of the glossopharyngeal nerve in patients with the carotid sinus syndrome has positively shown that all the effects resulting from pressure on the sinus are transmitted by this nerve since the carotid sinus syndrome appears to be largely due to pressure stimuli. Intracranial division of the glossopharyngeal nerve is an ideal neurosurgical procedure inasmuch as regeneration of the nerve is impossible and local surgery is avoided thus eliminating the danger of injury to the carotid artery.

GEORGE R. GRANGER, M.D.

## SPINAL CORD AND ITS COVERINGS

**Transperitoneal Approach to the Intervertebral Disc in the Lumbar Area** JOHN D. LANE, JR., and EMORY S. MOORE, JR. *Ann. Surg.* 1948, 127 537

According to the authors, the syndrome of low back pain due to alterations in the intervertebral discs although well recognized clinically leaves much desired in its surgical treatment. Numerous articles report instances of the early recurrence of symptoms or only partial help after present surgical procedures. To improve on some of the undesirable features of the current operation transperitoneal approach with or without bone implantation into the intervertebral space after removal of the diseased disc has been devised. The object of such a procedure is



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JOHN MARX, M.D.

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## SPINAL CORD AND ITS COVERINGS

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According to the authors, the syndrome of low back pain due to alterations in the intervertebral discs although well recognized clinically leaves much desired in its surgical treatment. Numerous articles report instances of the early recurrence of symptoms, or only partial help after present surgical procedures. To improve on some of the undesirable features of the current operation, transperitoneal approach with ex bone implantation into the intervertebral space after removal of the diseased disc has been devised. The object of such a procedure is

2 To remove completely the pathological disc with the cartilaginous end plates of the adjacent vertebrae.

3 To wedge the disc space open with an ox bone implantation to maintain normal space between the adjacent vertebrae and cause firm bony fusion.

Several undesirable features of the present posterior approach add to the desirability of the new technique. The usual route with hemilaminectomy frequently gives inadequate exposure so that if anterior herniation of the disc has occurred complete visualization is not always possible. In exposure of the disc, retraction of the nerve roots may result in their irritation or permanent damage, hemorrhage from the anterior longitudinal veins often prevents complete visualization and has been found to cause postoperative sequelae by hematoma formation with consequent fibrosis and nerve root adhesions and only a small part of the disc and cartilaginous end plates can be removed through the posterior approach. Because of the removal of the nuclear material without substitution of any other substance, there is narrowing of the disc space with joint instability.

The advantages of the anterior transperitoneal route are listed.

1 There is adequate visualization of the entire disc space and cartilaginous end plates.

2 The third, fourth, and fifth lumbar discs can be examined and treated through the same (abdominal) incision.

3 Removal of the entire disc and cartilaginous end plates to obtain firm bony union can be accomplished.

4 Hemorrhage is easily controlled and does not occur into the spinal canal. Retraction of the nerve roots or cord is not necessary.

5. A large bone implant can be wedged into the disc space to prevent narrowing until fusion between adjacent vertebral bodies has taken place.

The procedure is described as follows.

After the patient is placed in a slight Trendelenburg position, a paramedian incision is made. The redundant portions of the sigmoid colon, cecum and small intestines are displaced into the upper half of the abdominal cavity. The pelvic colon is retracted to the left after the ureters have been identified. An incision is made in the posterior pelvic peritoneum beginning over the sacrum and extending to the bifurcation of the aorta. The kidney bar is now elevated sufficiently to cause hyperextension of the lumbar spine. The fifth disc is located by palpation between the common iliac vessels. The paracostal sympathetic nerve plexus and veins are freed by blunt dissection and retracted laterally which completely visualizes the anterior longitudinal ligament over the prominence of the fifth lumbar disc. A

transverse incision is made across the anterior longitudinal ligament at the lower margin of the fifth vertebra and from the midportion of this a vertical incision is made to the upper margin of the sacrum. These flaps are reflected and the entire contents of

the disc space are removed by a curette until the ligaments retaining the disc are visible. These ligaments are explored and if defects are found, they are further opened to determine if nuclear material has been extruded. If so, this is removed. The cartilaginous end plates are completely excised from the surface of the vertebrae by a chisel or curette.

To maintain the disc space in its normal width while fusion is progressing a specially prepared ox bone wedge is used. The wedge consists of a crescent shaped piece of bone which is driven into the disc space while the spine is hyperextended. Between the wings of the crescent, a large square bone peg is placed. These pieces fill the disc space completely. The flaps of the anterior ligament are closed and sutured over the disc space in normal position.

Exposure of the third and fourth disc spaces is slightly more difficult, but can be accomplished by retracting the ureter to the right, and the vena cava and aorta to the left.

Closure consists of suturing the anterior longitudinal ligaments to adjacent vertebrae, and stitching the posterior peritoneal layers and the various portions of the anterior abdominal wall.

Postoperative care emphasizes combating intestinal distention and phlebitis. No cast or brace is used for 30 days, but the patient is kept supine on a hard surface. Roentgenograms of the lumbar region are then taken and a body cast is applied over the entire lumbar and sacral regions. With this, the patient is permitted to be ambulatory and is sent home. His condition is frequently evaluated with roentgenograms and if the convalescence is satisfactory he is supplied with a lumbosacral belt and advised to avoid strenuous exercise. He returns at monthly intervals for examination.

A diagnosis of herniated nucleus pulposus was made in 97 patients at the Marine Hospital, Baltimore, Maryland. Of these, 36 were subjected to surgery and the procedure described here was used. Among the 36 multiple discs were found in 11. A preliminary survey revealed improvement in 33.

The authors conclude by stating that obliteration of the involved disc spaces by bony fusion is necessary for complete amelioration of the symptoms due to intervertebral disc lesions.

C. FARRAR KIRK, M.D.

#### Surgery of Lumbar Intervertebral Disc Protrusion.

MURRAY A. FALCONER, MURRAY McGEORGE, and A. CHARLES BIRD. *B ILL J Surg* 44:3, 35-5.

From a New Zealand neurosurgical unit 100 consecutive operative cases of protruded lumbar intervertebral disc are analyzed. The case material was divided into two main groups that in which sciatica was the predominant feature, and that in which persistent severe low back pain predominated. The analysis includes discussion of the selection of cases, operative technique, complications, subsequent operations, and results of operative treatment of disc protrusion. The article is well illustrated with numerous photographs of surgical specimens, myelograms,

schematic drawings of the pathosis of protruded in intervertebral discs and 11 tables of statistics regarding the results and follow up of the patients.

The criteria for operation in all cases included a failure of at least 1 month's complete rest to relieve symptoms of sciatica or of low back pain. A positive myelogram in patients with severe low back pain alone was a factor necessary before operation was considered. However a normal myelogram in patients with severe intractable sciatica did not influence the decision to operate.

The authors did not limit their exposure to the interlaminar approach but performed a laminectomy bilateral if necessary whenever difficulty was encountered in obtaining proper exposure. Sixty-one of the 100 patients had a laminectomy. Spinal fusion is mentioned only in that it prolongs the convalescence and does not add appreciably to the good results of surgery for protruded intervertebral disc.

Two points regarding the positioning of patients for the operation are noted. To reduce the engorgement of the dural and extradural venous plexuses, it is advised to place sandbags under the groins and a pillow under the chest of the patient which will remove all pressure from the abdomen. When concealed or intermittent protruding discs are suspected, it is advised to hyperextend the patient's hips and spine while he is on the operating table as this maneuver will frequently bring the disc into view.

Although patients were kept in bed for 3 weeks during the postoperative period the authors stress the importance of back exercises in the convalescence. Exercises are started in bed on the tenth day and gradually increased throughout the period of rehabilitation. Usually a patient was ready to assume light work from 2 to 4 months after operation. From 4 to 6 months was required before a patient could resume heavy labor.

Fourteen of 100 patients were reoperated upon one or more times as symptoms due to inadequate removal of the disc continued after operation. Because of the degenerative changes occurring in other intervertebral discs and associated derangements of the intervertebral joints complete cure is not possible in all cases.

JOHN L. BELL, M.D.

### PERIPHERAL NERVES

**Brachial Neuralgia** W. RUSSELL BRAIN *Lancet* Lond., 1948 1: 393.

Most lesions of the cervical spinal nerves are partial and do not affect all forms of sensibility equally or all parts of the dermatome to the same extent. Subjective sensory disturbances are more common than objective sensory loss and more prominent than motor symptoms. According to the author the palmar surface of the thumb and index finger is included in the distribution of the sixth cervical dermatome the middle finger in the seventh, and the ring and little fingers in the eighth cervical dermatomes. He found that the dorsal aspect of the shoulder receives innervation from C7 and that

irritation of this spinal nerve causes pain to be referred to the shoulder and may cause pain and deep tenderness in the majority of the shoulder muscles which are innervated by its fibers.

The author discusses briefly the principal causes of brachial neuralgia and examines their symptoms and points of differential diagnostic interest. Brachial neuralgia may be caused by cervical spondylitis as a result of loss of intervertebral disc space or osteophytic outgrowths, and produces pain in the distribution of the sixth and seventh cervical nerves. Herniation of a cervical intervertebral disc most often of the seventh cervical, produces considerable pain in the neck, which is often not present in cervical spondylitis although the roentgenographic abnormalities are more striking. The costoclavicular syndromes may be produced by 14 different abnormalities involving the root of the neck: an abnormal seventh cervical transverse process, a fibrous band from the seventh transverse process to the first rib, a cervical rib, a first rib of abnormal shape, an unusually high first rib, a cervicodorsal scoliosis, an abnormal origin of the scalenus medius, an abnormal insertion of the scalenus medius, a hypertrophy or spasm of the scalenus anticus, an abnormal origin or insertion of the scalenus anticus, the passage of neurovascular structures through the substance of the scalenus anticus, loss of power or tone in the elevators of the shoulder girdle allowing the inner cord of the brachial plexus to impinge on a normal first rib and costoclavicular compression. The syndromes may be conveniently divided into those with and those without structural abnormalities. The latter group is more difficult to diagnose. One form, known as acroparesthesia, common in middle-aged women is thought to be of vascular origin and to be caused by weight carrying. It is characterized by awakening at night with tingling in one or more commonly both hands. The author has treated such cases successfully with vasodilators and found small doses of trinitrin and thyroid extract very effective. Most of the other cases of costoclavicular disturbances should be treated by exercises of the shoulder shrugging type as long as the symptoms and signs are purely sensory but when muscular atrophy or vasomotor symptoms are present surgical treatment is indicated.

Another cause of brachial neuralgia is the compression neuritis of the median nerve in the carpal tunnel often produced by fractures or other structural abnormalities of the lower end of the radius or of the proximal carpal bones. It produces sensory and muscular disturbances in the distribution of the median nerve. Treatment consists in immobilization or decompression of the swollen nerve in the carpal tunnel. It is occasionally followed by a Raynaud's syndrome. Spinal tumors only rarely produce pain simulating a brachial neuralgia but produce other definite signs and symptoms.

The author stresses the importance of a thorough clinical examination and the great value of roentgenographic studies.

GEORGE PERRET, M.D.

### SYMPATHETIC NERVES

Serious Accidents Occurring with Infiltration of the Stellate Ganglion (Les accidents graves de l'infiltration tellaire) G. ARNOLD *Rev. chir. Par.* 945 67 73.

Although infiltration of the stellate ganglion according to the author is definitely indicated for numerous conditions, several complications occur

1. Fatal accidents. The author describes 12 cases in which death occurred because of infiltration of the stellate ganglion. Three deaths occurred in patients with angina pectoris, 7 in patients with acute asthma,

death took place in a patient with a malignant tumor in the cervical region, and another in a patient with chronic arachnoiditis. Ten of these patients (those with the heart and asthma conditions) were poor risks when they first presented themselves. According to Danileopolu infiltration of the stellate ganglion is dangerous in patients with angina pectoris because it paralyzes the sensory fibers of the heart and suppresses the anginal pain which is supposed to act as a "warning signal." This conclusion is not supported by the author.

Most important is the danger of injection of the anesthetic into the vertebral canal which produces a cervical or medullary anesthesia and subsequent death. It is necessary before any anesthetic agent is injected that one is certain that the cerebrospinal fluid cannot be withdrawn.

2. Pulmonary accidents. The chief complication here is the production of a pneumothorax which, although not particularly serious, is painful for the patient.

3. Medullary accidents. These accidents are attributed to injection of the anesthesia into the cerebrospinal fluid and may be due to an idiosyncrasy to the agent used. However this view is not supported by the wide usage of novocaine elsewhere in the body. Such deaths are probably the result of a paralysis of the central nervous system at these levels.

4. Nerve accidents. Damage to the laryngeal nerve and brachial plexus has been reported from technical errors in placement of the needle.

The following suggestions are given by the author to avoid complications during injection of the stellate ganglion.

The transverse vertebral process is used as a point of reference and the superior external approach is considered the best. Before injection of the anesthetic it is mandatory to aspirate the syringe to determine if reflux of blood or cerebrospinal fluid occurs. If such does occur the location of the needle should be changed.

The author concludes by stating that indications for injection of the stellate ganglion should not be reduced because of possible complications but, rather more rigorous attention should be paid to the technique of this procedure.

C. FREDERICK KITTLE, M.D.

# SURGERY OF THE THORAX

## CHEST WALL AND BREAST

**Management of Breast Tumors—An Analysis of 336 Cases.** JOHN A. WOLFER and WALTER W. CARROLL. *Q. Bull. Northwest. Univ. M. School* 1948, 22, 86.

Of the 336 patients whose cases are reported 170 had carcinoma, while the remainder (6 of whom had multiple tumors) presented benign lesions. The malignant group was essentially of 2 types: scirrhous carcinoma (88) and adenocarcinoma (58). The benign specimens presented 2 large main groups: the freely moveable adenomas (44) and the somewhat imbedded tumors with varying stages of cystic dysplasia (95).

In age the patients ranged from the early teens to the eighties. Those in the fourth decade showed a preponderance of benign tumors while those in the sixth showed a preponderance of malignant tumors.

A history of breast pain or tenderness in the tumor was quite constant in the benign tumors while the absence of pain was characteristic of the malignancies.

An even distribution of tumors between breasts may be expected but the upper outer quadrant presents more disease of malignant, as well as of benign type than any other equally sized area of the breast.

The diagnostic significance of nipple discharge in its relationship to malignancy has been overrated. Papillary carcinoma is the only logical type of malignant tumor to be accompanied by bleeding from the nipple.

The primary malignant mass is usually stony hard and fixed in the breast substance. As the malignant tumor grows a replacement phenomenon accompanied by the production of contracting scar tissue occurs. As the fibrous septa connecting with the skin become involved and secondarily pulled out of alignment, the overlying skin will be retracted inwardly to form a slight dimple. The presence of a dimple is the earliest of the retraction signs. As the tumor grows to involve more of the subcutaneous tissue, the overlying skin may actually be retracted and fixed.

Palpable axillary nodes are to be regarded with suspicion but their absence is not of diagnostic value. It has been found that in cases of proved cancer of the breast, with preoperatively palpable nodes, the incidence of negative nodes was 32 per cent, while in patients with no palpable nodes the incidence of positive nodes was 29 per cent. In the series reported the incidence of positive nodes was 54 per cent.

Microscopic identification following surgical removal is the only accurate method of diagnosis.

SAMUEL KAHN, M.D.

**The Use of Male Hormones in the Treatment of Cancer of the Female Breast** (L'utilisation des hormones mâles dans le traitement du cancer du sein chez la femme) ANDRÉ SICARD. *Presse méd.*, 1948 56, 149.

The influence of ovarian secretion on breast cancer is recognized both experimentally and clinically. One may combat cancer of the breast by castration either surgically or by irradiation by the administration of androgenic substances or by a combination of these methods.

The author relates his experiences with 18 patients who had cancer of the breast with metastases, most of which were osseous. Two were treated with androgenic substances alone while the remainder were subjected to either surgical or irradiation castration and in addition were given androgens. The growth of all the metastases was checked, all of the patients were relieved of pain and their general condition was improved to such an extent that they were able to live almost normal lives.

It is upon the metastases that the effect of castration is most marked. However, the immediate results from ovarian castration as the sole procedure are quite unpredictable and there is a marked variability in the duration of relief from pain. These phenomena are probably due to estrogenic activity in other locations in the body. In the postmenopausal female as in the castrated animal one may find estrogenic hormones in both the blood and urine. The estrogenic substances may arise from the adrenal, the hypophysis, the thyroid, or perhaps the thymus glands. At any rate, the source is a problem of endocrine physiology which has not yet been solved.

The diminution of estrogenic secretion by castration alone is only temporary and incomplete. Because of this fact, the author suggests the use of androgenic substances which combat the effect of all estrogenic substances regardless of their source. Many have hesitated to use hormone therapy as a complementary form of treatment immediately following radical breast resections but rather reserve its use for advanced inoperable cases. The author condemns this point of view and suggests that androgenic substances be used in those cases which are operable as an adjunctive form of therapy.

The use of large doses of testosterone to reach a total of from 3,000 to 4,000 mgm. is indicated during the period of treatment, which in most cases lasts about 3 months. Large doses give more rapid and more lasting relief from pain. The appetite is increased and the bony lesions are recalcified. The substance is administered by pellet implantation and reinforced by three weekly intramuscular injections until the desired dosage and effect are reached. The hormone therapy is discontinued before masculinization becomes too marked.

ORVILLE F. GRIMES, M.D.

**Evaluation of Skin Grafting in the Technique of Radical Mastectomy in Relation to Function of the Arm.** CHARLES G. NEUMANN and HERBERT CORWAY. *Surgery* 94:8, 3 584.

A study of 308 patients operated upon for carcinoma of the breast is presented. The investigation was primarily conducted in an attempt to evaluate the function of the arm following radical mastectomy. The technique of resection was similar in all cases, but there was variation in the type of closure. In 95 cases the wounds were closed primarily. In 131 a small skin graft was used, and in 59 a large skin graft was necessary to cover the defect on the chest wall. Closure with a small skin graft was followed by full function of the arm in the highest percentage of cases. The use of postoperative radiation regardless of the type of closure of the wound was associated with an increased number of patients who showed poor function of the arm.

Statistics are presented which show that closure of the wound of radical mastectomy with a skin graft provides full function of the arm in a greater number of cases than when simple linear closure is used. The use of the skin graft preserves the elasticity of the lateral cutaneous flap which normally allows for full abduction of the arm. ORVILLE F. GIBBS, M.D.

### TRACHEA, LUNGS, AND PLEURA

**Surgical Treatment of the Solitary Lung Metastasis.** DONALD B. EFFLER and BRIAN BLADEN. *J. Thorac. Surg.* 94:5, 7 7.

Excisional therapy of the solitary lung metastasis is indicated when the primary tumor has been extirpated and when careful search reveals no manifestation of extension other than the solitary metastasis. Metastases have been known to regress and disappear following removal of a primary renal carcinoma. This is an interesting and little understood phenomenon, but it should not be considered a contraindication of surgery for the solitary metastasis.

A solitary metastasis may appear early or very late as long as 10 years after removal of the primary tumor. It is difficult to understand why the development of the late metastasis is delayed. It is reasonable to assume, however, that the chance for a cure in excision of the solitary metastasis is better when the metastasis appears late.

SAMUEL KAHN, M.D.

**Bronchial Carcinoma Presenting as Polyneuritis.** R. WYBURN-MASON. *Lancet* Lond., 948 1 903.

Three cases of polyneuritis complicating bronchial carcinoma are described. In each case the pulmonary symptoms were in abeyance and the patients sought aid for neuritic symptoms.

The patients were men aged 53, 50, and 71 years respectively. In 2 cases the right lung and in one case the left lung was affected. In 2 cases the tumors were comprised of small round cells, and in the third case the tumor was made up of "oat cells." The

cerebrospinal fluid in 2 cases was normal, whereas in the third case it contained 100 mgm. of protein per 100 ml. The course of these cases, from the onset of symptoms to death, ranged from 5 to 14 months.

The etiology of the polyneuritis is discussed and it is concluded that this condition is the result of a nervous reflex from the lung.

JOHN J. MALONEY, M.D.

**Progress in Bronchology.** LOUIS H. CLEGG. *J. Am. Med. Ass.* 94:8 136 735.

Bronchoscopy is now employed as an aid either in diagnosis or in treatment of practically all bronchopulmonary diseases associated with bronchial obstruction or with an increase of bronchial secretions.

In bronchogenic carcinoma, bronchoscopic biopsy yields a positive diagnosis in from 60 to 80 per cent of the cases. Positive bronchoscopic diagnoses, however, give too few opportunities for successful surgical extirpation of the tumor. It is evident that, in order to treat the disease successfully it is necessary to make the diagnosis earlier before large bronchi are obstructed. With the aid of collection tubes and aspirators, secretions may be secured bronchoscopically from the site of the suspected carcinoma, and the cells studied. In cases in which the lesions are beyond bronchoscopic vision, the diagnosis can often be established by this means. Complete surgical removal can then be carried out in a higher percentage of the patients with bronchial carcinoma beyond the field of bronchoscopic vision, than of those in whom the lesion is diagnosed by bronchoscopic biopsy.

Many patients with endobronchial benign tumors have been successfully treated by instrumental removal and diathermy bronchoscopically. Adenoma often occurs as an endobronchial or extrabronchial tumor and it may undergo cancerous changes. Surgical extirpation, therefore, must be considered in its treatment.

In the treatment of pulmonary abscess prophylactic measures, sulfonamides and antibiotic drugs, as well as surgery, have turned the trend away from bronchoscopy. It remains a valuable diagnostic aid, however. In cases of suspected bronchial obstruction complicated by pulmonary abscess.

Bronchoscopy still has a definite place in the medical management of patients with bronchiectasis who are not suitable for surgical treatment. It is also of value in the medical preoperative and postoperative care of the surgical group.

In bronchial asthma, the bronchologist must often investigate the tracheobronchial tree to rule out conditions that stimulate asthma and to remove secretions from the air passages. In status asthmaticus, one of the most common causes of death is the blocking of the larger air passages by thick, tenacious secretion. When medical methods fail to remove these secretions, their mechanical removal by bronchoscopic aspiration is often necessary to relieve the marked dyspnea. Bronchoscopic or catheter aspiration also has a definite place in the medical

management of postoperative conditions in which the secretions cannot be coughed up from the air passages.

Routine diagnostic bronchoscopic examination of all tuberculous patients shows an incidence of tuberculous tracheobronchitis in about 10 per cent. Direct inspection is indicated as a diagnostic procedure in cases of pulmonary disease in which the diagnosis has not been definitely established. This includes the large group of cases of obscure chronic cough hemoptysis and wheezing respiration as well as those with unexpected roentgenographic findings and physical signs. When there is doubt whether bronchoscopy should or should not be done in any case of pulmonary disease it should be done provided there are no contraindications.

SAMUEL KAHN M.D.

An Experimental Study of the Effect of Ligation of Pulmonary Veins in the Dog HENRY SWAN and R. M. MULLIGAN *J. Thorac. Surg.*, 1948, 17: 44.

These experiments were conducted specifically to study the changes resulting from interruption of the venous outflow from the lungs. The authors did not find the answer to this question in any previous publication.

Dogs were utilized and the operative stages were carried out under strict asepsis. The pulmonary vein was doubly ligated and severed. In 11 dogs the veins to the right upper lobe were so treated and in 2 dogs the veins supplying the entire lung were ligated. The only deaths (3) in the first group of dogs occurred in animals which underwent additional though unrelated operative alterations or were under the effect of dicumarol. The other 8 dogs survived from 23 to 134 days when they were sacrificed. Both dogs in the second group which underwent total venous ligation died within 3 days. The authors concluded that death under these circumstances was an expression of the extent of involvement and possibly was based on the blood loss incurred.

Having sacrificed the animals at varying lengths of time postoperatively the authors believed they could trace the sequence of events taking place within the lobe. The first reactions in the lobe include a fibrinous or fibrinopurulent pleuritis with adhesions of the lobe to the parietal pleura. The lobe is pumped full of blood by the intact arteries to it. Consequently severe hyperemia hemorrhage and edema are noted involving especially the alveoli alveolar ducts and bronchioles. Along with the reduced vitality of the pulmonary parenchyma bronchopneumonia becomes an accompanying reaction. As a result of the ligation thrombosis occurs in the veins to the lobe.

The process of recovery from these acute changes includes the establishment of adhesions between the visceral and parietal pleura through organization of the acute pleuritis. Along with this reaction blood monocytes coming into the arteries migrate from the alveolar capillaries into the alveoli and alveolar ducts and pick up cell debris. Granulation tissue

grows out into the alveoli alveolar ducts and bronchioles to organize contained exudate. In addition air is evidently resorbed from some alveoli and alveolar ducts. Widespread atelectasis results from the emptying of the contents of these structures by both the scavenging of the hemorrhagic and inflammatory debris and the resorption of edema fluid and residual air. As the collateral blood supply established by the pleural adhesions becomes more abundant in the later stages the still intact arterial blood vessels are able to vascularize the lobe, especially the alveolar capillaries and the still intact bronchial tree is able to admit air for the re-expansion of the lobe. The atelectatic areas then largely disappear the re-expansion beginning first at the periphery of the lobe and then extending centrally. The granulation tissue within the alveoli alveolar ducts and bronchioles is either resorbed or incorporated into the interstitial fibrous connective tissue.

The final result after 3 or 4 months is a lobe at least 80 per cent re-expanded and apparently functioning with residual vascularized pleural adhesions and focal interstitial fibrosis and hemosiderosis. The thrombi in the proximal ends of the severed veins to the lobe become organized and the veins are recanalized to different degrees.

HIRAM T. LANGSTON M.D.

A Hitherto Unrecognized Tendency to the Development of Widespread Pulmonary Vascular Obstruction in Patients with Congenital Pulmonary Stenosis (Tetralogy of Fallot) ARNOLD R. RICH. *Bull. Johns Hopkins Hosp.*, 1948, 83: 389.

Pulmonary vascular obstruction was found in 90 per cent of 21 consecutive cases of tetralogy of Fallot. The obstruction in question results from widespread focal thrombosis of pulmonary vessels of microscopic size. Both arteries and veins are involved. Frequently the wall of the affected vessel is altered beyond recognition during the process of organization of the thrombus. Every stage is present from the formation of fresh thrombi to the organization and recanalization of the older ones, and it is clear that the process is often a progressive one. It is especially emphasized that the thrombi in these cases tend to occur profusely throughout both lungs.

The thrombi do not result from the operative procedure. The lesions are found not only in patients who have died without operation but also completely organized and recanalized thrombi can be found in patients who expired on the operating table or within a few hours after the procedure designed for the relief of the effects of pulmonic stenosis.

There is no evidence that the arterial thrombi represent emboli from extrapulmonary sites. No thrombi were found in the hearts and in cases of other types in which thrombi in the heart or systemic veins serve as the source of pulmonary emboli diffuse obstruction of minute pulmonary vessels is not encountered. Study of the other viscera in these cases disclosed no diffuse thrombosis, as was found in the lungs.



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Both polycythemia and the inadequate pulmonary blood flow resulting from pulmonary stenosis favor the spontaneous thrombosis in the pulmonary tree noted in these patients. Whether the increased peripheral resistance in the pulmonary circulation in cases with widespread obstructive thrombosis of the pulmonary vascular bed places an additional burden upon the abnormal heart following the surgical procedure can hardly be answered on the basis of present information.

ORVILLE F. GRADEN, M.D.

**Medical Treatment of Acute and Chronic Pulmonary Abscesses.** DAVID T. SMITH, *J. Thorac. Surg.* 1948, 7:72.

Lung abscess, as represented by collected reports has carried a rather poor prognosis. The 34 per cent mortality rate has not been generally improved during the last 20 years although in certain clinics, in which emphasis on the surgical aspect of the disease has been made, rates as low as 2.6 per cent are recorded.

The prognosis in lung abscess depends upon many factors, such as the type of abscess whether single or multiple, whether complicated by bronchiectasis, the inhalation of material with or without irritating substances, and whether or not it is the result of vascular accidents such as thrombosis or infarction. Some evidence seems to point to a more favorable prognosis in abscesses which follow surgical procedures such as tonsillectomy, etc.

The type of bacterial infection is discussed at some length. In the nonputrid pyogenic abscess best results seem to indicate treatment by sulfonamides and penicillin, with resection if adequate improvement does not occur. In fusospirochetal abscesses, early diagnosis is important and treatment with penicillin, with or without arsenicals, sulfonamides, and streptomycin should be instituted promptly. Steady clinical and roentgenological improvement must be obtained by this approach within 6 weeks. If not these abscesses should be subjected to surgery.

The basic treatment of lung abscess includes bed rest and supportive treatment. Early institution of this regimen demands prompt diagnosis. To this must be added drainage regardless of the stage of disease, underscoring the fact that drainage can be secured by medical means such as posturing, and need not imply surgical intervention.

Bronchoscopy aside from ruling out important etiologic factors such as neoplasm or foreign body may well improve such drainage.

Antiseptic therapy has been variously appraised as to its effectiveness. The best results have been obtained during the first 10 days of disease while the process was still in its pneumonic phase and necrosis was not appreciable. The author has previously reported 60 per cent cures.

Sulfonamide therapy was more effective in the pyogenic (gram positive cocci) rather than in the fusospirochetal abscesses.

Penicillin is probably the most effective single agent in the treatment of lung abscess.

When the abscess has entered a chronic phase medical treatment can hardly be successful. However, a case is reported in detail in which adequate surgical treatment was refused by the patient. The use of sulfonamides, neomarsphenamine desensitization by autogenous vaccine and potassium iodide over a period of 14 months eventuated in an acceptable clinical result, although roentgenological signs persist.

The statistical material submitted is based on reports collected from the literature and supplemented by data from 135 cases seen at Duke Hospital Durham North Carolina from 1940 to 1945 inclusive.

The generally gloomy picture presented for lung abscess is attributed to failure to recognize early lesions in the pre-abscess phase to clearly differentiate the type, and consequently a failure to institute appropriate therapeutic measures. Likewise, the limitations of "medical" treatment are not appreciated and surgical intervention is delayed beyond the indicated time.

HIRSH T. LAWTON, M.D.

**Arteriovenous Fistula of the Lung.** HERBERT C. MAIER, AARON HEMMELSTEIN, RICHARD L. RILEY and JOSEPH J. BURKE, *J. Thorac. Surg.* 1948, 7:3.

Cavernous hemangioma of the lung may result in a pulmonary arteriovenous fistula, with the development of cyanosis, polycythemia and clubbing of the extremities but these signs are absent in those pulmonary hemangiomas which do not result in a significant degree of shunt between the pulmonary artery and vein.

A case of arteriovenous fistula of the lung with superimposed bacterial endarteritis is reported. The patient was successfully treated with parenteral penicillin followed by surgical removal of the involved portion of the lung.

The physiological alterations produced by an arteriovenous fistula in the peripheral and pulmonary circulation are compared. A peripheral arteriovenous fistula causes an increase in all elements of the blood volume proportionately an increase in cardiac output, and dilatation of the heart. In contrast, a pulmonary arteriovenous fistula increases only the red cell mass, and has little or no effect on cardiac output and cardiac dynamics.

SAMUEL KAHN, M.D.

**Adenoma of the Bronchus. Review of 15 Cases.** LAZARO LAMORE and ENRI A. NACLERIO, *Ann. J. Surg.* 1948, 75:532.

Bronchial adenoma is a definite clinical and pathologic entity which accounts for about 80 per cent of benign bronchiogenic growths. No unanimity of opinion exists regarding its histologic origin, potential malignancy relationship to cancer of the bronchus, and treatment. If the criteria for carcinoma—involution of adjacent tissue, involvement of regional lymph nodes, and metastasis to distant organs—are accepted it must be concluded that some of the

bronchial adenomas fulfill all the requirements of malignancy. Aside from its potential malignancy the tumor eventually produces sequelae incident to bronchial obstruction—obstructive emphysema, bronchiectasis, total atelectasis, chronic pneumonia, pulmonary abscess and empyema.

In the early stages adenoma is usually asymptomatic although a dry cough may be present. Hemoptysis is a cardinal symptom; it is often profuse and is as sudden in its termination as in its onset. As the tumor encroaches upon the lumen of the bronchus symptoms of partial or complete obstruction may appear. A localized wheeze may be noticed. Dyspnea is common. Episodes of pneumonia characterized by cough, mucopurulent sputum, fever and chest pain occur. As the tumor progresses filling the lumen of the bronchus obstructive effects with irreparable damage to the lung develop as in carcinoma so that the clinical picture is then one of either atelectasis, bronchiectasis, lung abscess or empyema.

A plain roentgenogram may present evidence of the existence of the tumor especially related to the secondary effects caused by obstruction. The tumor itself is demonstrated only occasionally. Bronchography may with reasonable accuracy outline the typical cap-shaped defect in the bronchus. Bronchoscopy is the most helpful diagnostic procedure available. The tumor almost invariably arises in the major bronchi and is easily accessible to biopsy and histologic study. The mobile polypoid, soft smooth pinkish rounded mass seen protruding into the bronchial lumen is typical. Ulceration is rarely seen.

Exploratory thoracotomy should never be delayed when other diagnostic methods have failed to substantiate the diagnosis of adenoma.

Histologically bronchial adenoma is characterized by the rarity of mitotic figures, the tendency for the cells to be grouped and the uniformity of the cell type. The cells are small and cuboid; they contain a dark nucleus. They are grouped in a variety of patterns which may be alveolar, columnar or mosaic in type, according to the arrangement of the stroma which divides the cells into groups.

The methods of treatment of bronchial adenoma are three: (1) radiation therapy, (2) bronchoscopic treatment including (a) implantation of radon seeds, (b) electrocoagulation and (c) forceps removal and (3) surgical extirpation, lobectomy or pneumonectomy. Surgical removal is the treatment of choice.

Fifteen cases of bronchial adenoma cured by pulmonary resection, 10 cured by pneumonectomy and 5 by lobectomy are reported. SAMUEL KAMR, M.D.

**The Clinical Picture of Encapsulated Empyema with Special Consideration of the Complications** (Das klinische Bild der Empyemathoraxen mit besonderer Berücksichtigung der Komplikationen) *Deut. med. Wochschr.*, 1947, 72: 665.

The central theme of this article concerns the serious complication resulting from long standing empyema cavities. Sixty patients with encapsulated

empyemas were treated after having spent from 5 months to 3 years in other hospitals, where either a correct diagnosis had not been made or treatment had been inadequate. Over 80 per cent of the patients had empyemas resulting from war wounds of the chest, most of which were complicated by injuries to the abdomen, neck, or both.

A severe state of malnutrition was noted in most of the patients. The authors do not hesitate to mention that the inanition frequently resulted from lack of recognition of the underlying disease process even though some patients were hospitalized for as long as 3 years. A rather profound anemia was present in most cases. Extensive liver damage resulting mainly from glycogen deficiency was not uncommon. Myocarditis was noted in about 25 per cent of the patients and clubbing of the fingers and toes was demonstrated in 22 patients. Rather severe polyarthritides was present in well over 50 per cent and a brain abscess led to the fatal termination of one case. Bronchial fistulas were common.

The various complications frequently of life-endangering severity could have been prevented by early diagnosis and adequate drainage. However, the extent of the empyema cavity frequently could not be determined even roentgenologically. Some large cavities were not diagnosed at all while others were believed to be much smaller than they actually were. Small cavities were occasionally overlooked especially when overlaid with aerated lung tissue or by an area of pleural thickening. The authors suggest the use of radiopaque substances in order to outline the residual cavities completely.

The types of operative therapy used were not discussed. However it is quite probable that a limited thoracotomy with adequate drainage was performed. There were cures in 49 of 55 operative cases while 6 patients died either from the effects of the operation or within the immediate postoperative period. Five other patients who were not operated upon died from the combined effects of the underlying disease and several complications. ORVILLE F. GRIMES, M.D.

**Primary Cancer of the Pleura. Roentgenologic and Endoscopic Symptomatology in 2 Cases** (Sul carcinoma primitivo della pleura. Semelologia radiologica e endoscopica in due casi). GIUSEPPE TOJA and REMO MARIANI. *Minerva med.*, Tor. 1948, 39: 20.

Two cases of primary cancer of the pleura are reported by the authors. In one case that of a man 53 years of age the condition had existed 7 months and in the other case, that of a 50 year old woman it had existed 11 months prior to the admission to the hospital. The symptoms were pain in the chest, cough, dyspnea and asthenia.

Pleuroscopy and biopsy are the best diagnostic methods. They should supplement the x-ray studies, thoracentesis and bronchoscopic and sputum examinations in cases in which the diagnosis is obscure. In early stages the primary cancer of the pleura can be easily mistaken for a simple pleurisy.

In both cases reported by the authors the diagnosis was confirmed by the autopsy.

The authors prefer the term "carcinoma" to "endothelioma" because there is no general agreement as to the embryologic origin of the pleura. The treatment in both cases consisted of repeated aspirations of fluid from the pleural cavity. X-ray treatment was not employed.

JOSEPH K. NARAT M.D.

### HEART AND PERICARDIUM

**Pneumopericardium.** HERBERT WILLY MEYER.  
*J. Thorac. Surg.* 9:3, 7-62.

Pneumopericardium, and particularly its complication by an infection is a rare condition. It would seem that the cases of traumatic origin offer a better prognosis than those in which the infection of the pericardium is part of a general sepsis.

The production of this condition may be varied but can be considered under three broad headings such as (1) trauma (2) perforation from neighboring organs and (3) spontaneous development of fluid, pus, and gas in the pericardium.

The physical signs include a disappearance of the cardiac area of dulness, fever and tachycardia are constant. Usually the pericardium is enlarged and effusion is present. Weird and varied auscultatory signs are described.

Röntgen studies are most valuable and paracentesis is required.

A case of pneumopericardium occurring in a 23 year old woman seen during military service is reported. She was admitted to days after being injured by a grenade fragment which penetrated the pericardium through the anterior chest wall. X-ray examination showed a typical pneumopericardium enclosing a foreign body. After suitable preparation over a period of 24 hours, an anterior pericardiectomy was performed, and the third to the sixth costal cartilages were resected. A portion of the sternum was resected away. The foreign body was removed and the wound was left open for drainage to be managed subsequently by daily irrigation. The patient did well for a time but subsequently died at another installation in uremic coma, on the nineteenth postoperative day.

HIRSH T. LANGSTON M.D.

### MISCELLANEOUS

**Late Result (36 Years) of a Chondrectomy for Pulmonary Emphysema.** According to the Method of Freund (*Kunstliche Distansia* (36 anni) di una chondrectomia secondo Freund per enfisema polmonare). ANTONIO BOZZIO. *Bull. mem. Soc. fisiologica* 1947 7-65.

While examining a 70 year old patient who had consulted him for the relief of urinary disturbances (due to hypertrophy of the prostate gland) the author noticed a long linear scar on the right parasternal region of the patient's chest. On making fur-

ther inquiry he learned that the patient had undergone an operation for the relief of pulmonary emphysema 36 years before. His interest in this operation led the author to follow up the patient's past illness, review the literature and report the case.

The possibility of surgical cure of pulmonary emphysema was first expressed by W. A. Freund in 1859 on the basis of the hypothesis that emphysema was brought about by a morphological change in the thorax, the loss of elasticity of the costal cartilages being due to a certain fascicular derangement of the chondral tissue. The rigidity of the costal cartilage hinders the continuous movement of the thorax which accompanies the respiratory act and holds the thorax in a permanent position of inspiration. The lung subsequently becomes dilated.

At the turn of the century Freund restated his theory and in 1906 Hildebrand operated on the first case of pulmonary emphysema with favorable results.

Naturally discussion arose as to whether the rigid dilatation of the thorax in the position of inspiration was the causal factor of the emphysema, or whether the emphysema was due to a primary intrapulmonary lesion and the deformity of the thorax was a concomitant phenomenon.

Many clinical and anatomophysiologic data were presented to support arguments in favor of both of these theories. Freund did not contend that his hypothesis of the origin of emphysema explained all cases of pulmonary emphysema. Numerous variations in surgical technique arose to improve the operation.

The author's patient revealed the following history 36 years earlier he had experienced difficulty in breathing the difficulty being accompanied by periodic asthmatic attacks. He sought relief of his chest condition and entered the surgical service of the Clinical Institute of Surgical Pathology of the University of Torino. Here he was operated on according to the method proposed by Freund. Recovery was rapid and the patient's condition was greatly improved. After a year he had a recurrence of his difficulty in breathing which this time was accompanied by cough, catarrh and asthma. This condition did not prevent him from serving in the Italian Army during World War I.

Physical examination 36 years after the operation showed the patient to be in good general condition. Inspection revealed a 20 cm. linear scar in the skin in the right parasternal region the scar being loose and pliable. Expansion of the thorax was symmetrical but there was little motion of the chest on deep inspiration. The percussion note was resonant throughout. The lower border of the right lung was at the level of the ninth rib and that of the left lung was at the level of the tenth rib. Auscultation revealed medium and coarse rales throughout the chest. Roentgenograms showed the chest to be held in rigid inspiration, symmetrical on both sides with the lung fields clear and the shadows of the blood vessels and the bronchial tree accentuated. The dome of the diaphragm on the right side was at the ninth rib and

on the left side at the level of the tenth rib. The right ribs from the second to the fifth showed signs of irregular regeneration of bone at the site of the previous operation.

On looking up the operative record, the author found that his patient had been operated on by Mann on December 17, 1910, at which time a chondrectomy of the second to fifth right costal cartilages had been performed through a long right parasternal incision. Complete extirpation of the perichondrium in the case of each cartilage had been done and the ends of the denuded ribs were covered over by parts of the pectoralis major muscle. In the eyes of the surgeon such a disabling affection in the young patient of 35 years had seemed to justify the operation. Following the operation the patient's condition was markedly improved and when he reached the age of 39 in 1915 he served in the Italian army. At 70 years he showed typical emphysema, confirmed clinically and roentgenographically, but the condition inconvenienced the patient little and did not prevent him from working.

From a theoretical point of view it is interesting to note that the emphysema remained and that notwithstanding the destruction of the second to fifth right costal cartilages the thorax was symmetrical and was held in rigid inspiration with the dome of the diaphragm markedly depressed. In the long period of 36 years the anatomical condition became reestablished and the fact that the intervention had had a favorable influence on the patient's condition was demonstrated by the clinical course of the case. The ends of the second to fifth ribs showed ossification at the costochondral junctions and this contributed to the immobilization of the chest.

Whether pulmonary emphysema results from rigid deformity of the thorax as suggested by Freund or whether it is due to a primary pulmonary lesion as stated by Loeschle, the author concludes that surgical intervention according to the method of Freund is logical and should be carried out in certain selected cases which do not respond to medical treatment. He holds that surgical therapy is absolutely contraindicated in all cases complicated by chronic pulmonary infections and circulatory disorders in spite of the opinion of other authorities.

BLACKWELL MANHEIM M D

**Traumatic Diaphragmatic Hernia.** FRED HUGHES, LARRY H. KAY, P. H. MEYER, JR., T. R. HEDSON, and JULIAN JOHNSON. *J. Thorac. Surg.* 1948, 17, 99.

Between January, 1914 and April, 1946, 25 traumatic diaphragmatic hernia were operated upon by the Chest Surgical Section of the Kennedy General

Hospital at Memphis, Tennessee. Sixteen of these were in battle casualties, the remainder being unrelated to battle. In 17 cases the hernias were due to penetrating wounds and in 11 cases to contusions.

The location and extent of the diaphragmatic defect could not uniformly be correlated to classic areas of anatomic predilection, the wounding agent or to the severity of the original trauma. The herniation occurred immediately after the original injury in most instances, but good evidence is adduced that herniation occurred only as the result of added strain as long as a year after the injury. The dome of the left diaphragm was the site most frequently involved and accounted for 12 cases. The right side was involved five times and the remaining cases occupied various sites on the left side.

Not all cases were diagnosable preoperatively. Hernias were discovered as the result of exploratory thoracotomy in 8 cases. In the cases with hollow viscera a preoperative diagnosis is relatively simple roentgenographically, however. In only 2 cases was a true sac found. Adhesions, however, were always present. One hernia had extended into the pericardium.

The patients were operated upon transthoracically with adequate control of the operative field. In one instance resection of a segment of gangrenous colon was carried out. The ends were brought out as a colostomy through a left rectus incision. Also in one instance a cystic kidney was removed as a viscus contained within the hernia.

The diaphragm was repaired by two layers of interrupted silk sutures. If the muscle had been separated from the chest wall, it was reapproximated by sutures anchored through the chest wall, buttressed by an intrapleural repair as well. The phrenic nerve was cruised as a routine in the latter part of the series after a recurrence of the hernia occurred within 24 hours. This accident was presumed to be due to strenuous efforts directed at clearing the airway. It was believed that the phrenic paralysis did not interfere with diaphragmatic healing. A ventral successful repair was obtained in all instances.

The complications included the early recurrence mentioned, transient pleural effusion three times, transient pneumothorax once and an emphysema once. No deaths are recorded. Obstructive symptoms demanded emergency operation five times.

Emphasis is placed on the possibility of late development of herniation as the result of some added strain even though the original trauma may have been slight.

The article is amply illustrated.

HIRSH T. LAM, JR. M D

# SURGERY OF THE ABDOMEN

## ABDOMINAL WALL AND PERITONEUM

**Mesenteric Cysts.** MILLROY PAUL. *Arch. Surg.* 1943, 35: 308.

The case of a mesenteric cyst which caused repeated attacks of acute intestinal obstruction from its recurrent impaction in the pelvis is reported. Most mesenteric cysts are not diagnosed before operation because their occurrence is not borne in mind. Diagnosis may be difficult because of the small size or because of the large size of the cyst. In most cases, however, there is usually a well-defined central intra-abdominal cyst with mobility greater in the transverse than in the longitudinal direction. Complications arising from intestinal obstruction, intra-cystic hemorrhage or infection and from rupture into the peritoneal cavity may be encountered.

Enucleation of the cyst would be the ideal treatment but it is not always practicable. Care must be taken to avoid injury to the mesenteric vessels during the dissection of the cyst wall. Marsupialization of the cyst has been performed in cases in which dissection was considered too hazardous, following which the cyst has remained empty. A similar result has occasionally followed simple aspiration. In cases with involvement of the bowel by a complication, resection of the bowel together with the cyst has sometimes been done.

In the reported case, enucleation was successful. Histological examination of the cyst wall showed it to be a replica of small intestinal wall, lending support to the theory that these cysts originate from sequestration of a portion of the wall of the small intestine. The view that the fluid content of these cysts is often an accidental circumstance determined by the opening up of lymph or chyle vessels into the lumen of the cyst is favored by the findings in this case.

JOHN L. LINDBQUEST, M.D.

## GASTROINTESTINAL TRACT

**Gastroduodenal Ulcer a Spastic Disease. I.** BOKREDA. *Ann. Surg.* 1943, 74: 3.

This intriguing report is the result of observations during the course of extensive experiments in which a team of 31 investigators collaborated, most of whom were connected with Dutch universities. The German occupation of Holland, during which the entire population of 9,000,000 people were medically *de facto* experimental subjects, furnished a great deal of material which it is believed may throw some light on the theory of ulcer formation.

In Holland, as in the United States, an increased number of ulcers occurred immediately after the outbreak of war. Factors contributing to this situation included psychic factors such as fear, sorrow and rage, and later important changes in the diet. For many years the daily intake consisted of a total of

about 1600 calories with a relative diminution in consumption of protein and fat, and an increase in carbohydrates. Potatoes, a food high in cellulose, were eaten in much larger quantities than normal. These changes produced an increased peristalsis throughout the gastrointestinal tract of nearly the whole population with the result that many persons even suffered from nonbacterial diarrhea throughout the entire period of the occupation.

The increased incidence of volvulus, especially of the sigmoid, strangulated hernia, and anal fissures was observed in great numbers of individuals, while there was a diminution in the incidence of acute appendicitis. This observation indicates that increased peristalsis and spasticity of the gastrointestinal tract lead to a higher incidence of such lesions at the same time preventing the stagnation of secretions in the appendix.

Pyloric hypertrophy in adults in Holland was frequently observed, an indication of increased frequency of a spastic condition of the stomach. Roentgenologists demonstrated many cases in which the entire antrum of the stomach was rigid. Laparotomy revealed either cancer or ulcer but hypertrophy of the pylorus. Such direct observations of increase of frequency in spasm in the stomach sustain the neurogenic theory of ulcer of Von Bergmann. Interestingly enough, acidity of the gastric secretion decreased rather than increased during the occupation. Hence these observations do not support the theory of high acidity as the prime cause of gastroduodenal ulcer.

These considerations, plus others presented by the author, caused him and his group to examine the rationale for hundreds of resections performed daily for the treatment of gastroduodenal ulcer. The experiences during the occupation led them to conclude that diminishing the gastric acidity cannot be the cause of the success of gastric resection. In the author's opinion, the chief effect of resection seems to be the removal of that part of the gastroduodenum most susceptible to the spasm assumed to be the direct cause of the ulcers.

The present study while not affecting therapy has, in fact, led the author to the conviction that gastroduodenal ulcer is a spastic disease.

HAROLD LAUFMAN, M.D.

**Superficial Spreading Carcinoma of the Stomach.** ROSE GOLDEN and ARTHUR PURDY STOUT. *Am. J. Roentg.* 1943, 59: 157.

Carcinoma of the stomach, in order to be detected by roentgen examination, must produce alterations in the form or movement of the stomach wall. The demonstrability depends upon the location in the stomach and the gross growth characteristics of the neoplasm. The large majority of gastric carcinomas (95 per cent) occur in the antrum or media of the stomach where demonstration is very probable.

Malignant tumors have two basic growth characteristics (1) the mass-producing quality and (2) the invading or infiltrating quality. Upon these physical growth characteristics Stout has based the following classification of carcinomas of the stomach:

1. Fungating: grows into lumen and produces a mass (occurred in 15 per cent of 200 cases)
2. Spreading: grows along wall and produces no mass.
  - a. Superficial: spreads in the mucosa and submucosa (occurred in 14 per cent of 200 cases)
    - (1) Ulcerating: about 80 per cent
    - (2) Nonulcerating: about 20 per cent
  - b. Linitis plastica type: spreads in the submucosa, muscle coat and subserosa (occurred in only 2.5 per cent of 200 cases)
3. Penetrating: grows through the wall to the serosa (occurred in 26 per cent of 200 cases)
4. Unclassifiable advanced growths: found in 37.5 per cent of 200 cases.

The discussion is concerned with the superficial spreading type and its differential diagnosis. Superficial spreading carcinoma begins in and grows along the mucosa, replaces the mucous membrane and usually obliterates the mucosal folds. It usually penetrates the muscularis mucosae into the submucosa and may rarely penetrate to the serosa, but it does not destroy or replace the muscle. In contrast to the penetrating type, gastritis is invariably associated with carcinoma of the stomach.

In the past decade, 31 superficial spreading carcinomas of the stomach have been discovered by the Department of Surgical Pathology of the Presbyterian Hospital, New York. The average length of time between the onset of symptoms referable to the stomach and hospitalization was almost 2 years, the longest was 10 years and the shortest 1 month. One case was asymptomatic.

Sixty-seven per cent of the patients were men and 13 per cent were women. Their ages varied from 34 to 80 years, with the largest number (15) between 50 and 60 years.

One stomach contained 2 superficial spreading cancers. They varied in size from 1 sq. cm. to 180 sq. cm. In 2 cases mixed types of carcinomas were present. Two other cases showed multiple foci of superficial spreading cancer with uninvolved mucous membrane between them.

Metastases to the regional lymph nodes were present in only 15 of the 31 cases. The superficial cancer developed in the lower half of the stomach in 30 of the 31 cases. Cancer developed around an open peptic ulcer in 12 cases, in 3 of which secondary ulceration in the cancer occurred. In 2 cases cancer developed in the mucous membrane over the scar of a healed peptic ulcer. The carcinoma itself ulcerated in 14 cases, in addition to the 3 ulcerating cancers associated with open peptic ulcers already mentioned. In 4 cases superficial spreading cancer was present without ulcer.

An open ulcer was present therefore in 26 or 80 per cent of 31 cases. Caetecopy was performed in

11 cases and in 9 of these evidence was found which was consistent with or suggestive of cancer although in some cases multiple examinations were necessary. In 2 cases no evidence of cancer was apparent. There is little doubt that cancer developed during the period of examination in 2 cases.

Twenty nine of the 31 patients had roentgen examinations at Presbyterian Hospital of which 24 had either cancer or peptic ulcer with cancer. In 20 of these the ulcer was demonstrated by roentgenograms. Elongated spasm of the antrum associated with gastritis was found in 6 of the 20 cases, and a localized incisure at the level of the diseased area in 3 cases.

The difficulty in the diagnosis of superficial spreading carcinoma of the stomach lies mainly in three problems. These are the detection of cancer developing around an open peptic ulcer, the detection of cancer developing in association with spasm of the antrum and the possible effect of cancer growing in the mucosa alone or in the mucosa and submucosa, on peristaltic movements and flexibility of the wall. Roentgenograms taken *en face* may show that mucosal folds run into a peptic ulcer crater but stop at the edge of cancer. Under treatment a peptic ulcer should diminish in all directions but a cancerous crater diminishes in depth but little or not at all in transverse diameter.

Cancer causes muscular spasm and when the spasm increases either in degree or length during observation carcinoma should be suspected.

It seems advisable to assume that carcinoma is probably present if dampening or obliteration of the peristaltic impression occurs over a localized area particularly if small irregularities of the margin or other suggestive signs are present.

This article contains some excellent photographs of roentgenograms which exemplify the subject material.

LESTER D. BLOOMENTHAL, M.D.

**Vagus Nerve Resections.** WALTMAN, WALTERS, HAROLD A. NEIBERG, WILLIAM F. BRADLEY, JOHN T. SMALL, and JAMES W. WILSON. *J. Am. M. Ass.*, 1948 136 743.

The present report is confined to a summary of the results of resections of the vagus nerve in the treatment of peptic ulcer, both favorable and unfavorable in the authors' cases, which now total 50 and in the cases of their colleagues which now total 68. In the authors' cases resection of the vagus nerves had been performed in 34 patients with duodenal ulcer in 7 with gastric ulcer and in 9 patients with gastric ulcer. The patients who were selected to undergo resection of the vagus nerve were chosen from that group of approximately 12 per cent of all patients with duodenal ulcer (at the Mayo Clinic) in whom an operation of some type was thought to be necessary, since nonsurgical methods had failed. In only 19 of the authors' series of 50 cases was it thought advisable to do a vagus nerve resection without some other simultaneous operation on the stomach such as a drainage operation to prevent postoperative gastric stasis or excision of a gastric ulcerating



lesion in their colleagues series vagotomy was done in 3 of 68 cases without other procedure on the stomach.

A complete vagus nerve resection relieves the pain of ulcer and there is a marked reduction of gastric acidity to an achlorhydric state in more than 50 per cent of cases. These results are secured at the expense of tonicity of the stomach dilatation of the stomach occurs, and may produce troublesome symptoms such as frequent belching of foul gas, a feeling of epigastric fullness and occasionally nausea vomiting and diarrhea. In the authors' experience, relatively few of the patients with duodenal ulcer who are operated on at Mayo Clinic have nonobstructing ulcers.

In only 6 of the 34 patients with duodenal ulcers who were operated on by the authors had vagotomy been done without other simultaneous gastric operations. Six had complete relief of symptoms, some up to a year after operation. Despite this, roentgenologic examination on dismissal showed a duodenal ulcer without crater in 4 patients, 2 of whom gave a positive reaction to the insulin test. Three of the 10 patients had no distress from the ulcer but did have fullness and bloating and 1 of the 3 was having diarrhea 6 months postoperatively. One of the 10 patients died one hour after operation of coronary insufficiency.

Sixteen of 22 patients who underwent vagotomy associated with gastroenterostomy had good results despite the fact that 7 had some fullness after meals in the early postoperative period, and 1 of the 7 had a physiologic obstruction for 20 days which necessitated jejunojunostomy. Four patients had mild symptoms of diarrhea with bowels moving loosely two to four times a day. Two patients had early retention of gastric contents and later had bad results.

Two patients had other gastric operations—one, a partial resection, the other excision of the ulcer and pyloroplasty. Both patients obtained relief of the distress from ulcer; the results of the insulin test were negative and there was achlorhydria.

There were 7 cases of gastrojejunal or postoperative gastroduodenal ulceration. These patients gave histories of intractable pain of long duration. In 4 of the 7 results were excellent, with relief of pain and with no complaints of fullness, bloating, nausea, or diarrhea; the other 3 patients had what might be considered satisfactory results.

It was considered advisable to perform vagus nerve resection in a small series of patients with gastric ulcers of various sizes, in order to determine the results of the operation and to compare them with the results in patients who had undergone partial gastrectomy for ulcer. Nine patients were chosen for the procedure. The 9 patients with gastric ulcer obtained relief from pain and reduction of gastric acidity but 3 had prolonged disturbances of motility. One ulcer failed to heal and one ulcer recurred despite apparent complete section of the vagus nerves, as demonstrated by clinical and laboratory tests including the insulin test.

The 63 patients on whom operation was performed by colleagues of the authors at the Clinic included 37 with duodenal ulcer, 30 with gastrojejunal ulcer and 1 patient only with gastric ulcer. In 8 patients with duodenal ulcer vagotomy only was performed; in 5 of these, the operation was done transthoracically and in 3 abdominally. Four of the 5 patients who underwent vagotomy by the transthoracic approach had good results, although 2 had some trouble immediately after operation. One patient had early retention with belching and fullness; this patient had a reduction in gastric acidity but no insulin test was done. Eight months after operation he had no distress from ulcer but he complained of gas and occasional episodes of diarrhea. One of the 3 patients who underwent abdominal vagotomy was well at dismissal and had a reduction of gastric acidity. Another patient had retention early after operation with intermittent periods of vomiting and diarrhea 3 months postoperatively. The third patient died suddenly on the fourth postoperative day and, although autopsy was not performed, death was thought to be due to an embolus.

Twenty-five patients with duodenal ulcer underwent vagotomy and gastroenterostomy. Twenty-four of these had relief of symptoms of ulcer. However, 6 patients had disturbances of motility characterized by epigastric fullness, nausea, or diarrhea. One patient with marked postoperative gastric retention and hypoproteinemia died on the fourteenth postoperative day. At necropsy an unexpected perforated duodenal ulcer with subdiaphragmatic abscess was found. Four patients underwent pyloroplasty in addition to vagotomy. All of these obtained relief of distress from ulcer. Only 2 had disturbances of motility of any consequence.

There were 30 cases of gastrojejunal ulcer in which vagotomy was done. In 3 of these the operation was performed too recently to permit of evaluation. Of the remaining 27 cases in 15 the operations were done transthoracically and in 12 abdominally. Nine of the 15 patients had good results from transthoracic vagotomy with absence of all symptoms of ulcer. Three patients had unsatisfactory results with recurrence of the symptoms of ulcer.

In 7 patients the existing anastomosis was not disturbed, the abdominal approach being used. 4 of these had had previous gastroenterostomy and 3 gastric resection. Three had obtained good results clinically; 3 still complained of minor degrees of fullness and diarrhea several months after operation, and the remaining patient noticed gas and dizziness when hungry which was relieved by frequent small meals.

One patient underwent disconnection of the enteric stoma as well as vagotomy. He had no drop in gastric acidity and the insulin test gave positive results. He suffered from retention and vomiting for a month and was still belching foul gas and vomiting occasionally 4 months later.

One patient underwent disconnection of the enteric stoma and pyloroplasty with good results. One pa-

tient had the gastroenteric stoma disconnected and a gastroduodenostomy was done. He had occasional ulcer distress and fullness but he was in good health otherwise. Two patients with gastrojejunoileic fistula had good early results after disconnection of the enteric stoma, closure of the fistula, and re-establishment of the enteric stoma, in addition to vagotomy. One patient died at home 334 months after operation from a coronary occlusion (as reported by his home doctor).

Only 1 patient with gastric ulcer which was located in the pyloric ring was studied by the authors' colleagues. The ulcer was excised and pyloroplasty was done simultaneously. The patient obtained early relief of symptoms and a reduction in acidity. No insulin test or postoperative roentgenogram was made.

#### Measured Radical Gastrectomy A. HENLEY VICK

Lancet Lond., 1948, 1: 505-557

To discover the limitations and the advantages of a Polya type of gastrectomy a consecutive series of 500 cases has been followed up by the author at regular 6 month intervals since operation. This series included all patients operated upon by the author in the period from 1936 to 1947 except those given emergency treatment.

The indication for operation in most patients was severe and persistent pain unrelieved by medical treatment. The distribution of the ulcers was as follows:

Type of Ulcer	Male	Female	Total
Duodenal	322	35	357
Gastric	47	21	68
Combined	38	7	45
Secondary	32	3	35
	439	66	505

The terms gastrectomy, partial gastrectomy, and subtotal gastrectomy have no precise anatomical significance. Most surgeons remove either 'half' to two-thirds or two-thirds to three-quarters of the stomach, but the author feels strongly that the size of the ventriculus remaining is more important than the portion of the stomach removed. Thus, instead of making what is inevitably a vague guess at the proportion of stomach removed, a concentrated effort is made to measure the exact size of the part left *in situ*. The line of section of the stomach is made so as to leave a small devascularized remnant 1.5 inches along the lesser curvature and 3 inches along the greater curvature (Fig. 1).

The measured radical gastrectomy differs from a conventional three-quarters gastrectomy in three respects: the area of stomach which remains can be measured and controlled with accuracy; the gastric remnant is extensively devascularized; and in 98 per cent of the cases permanent achlorhydria results. The essential point of technique is division of all but one of the vasa brevia and all branches of the left gastroepiploic artery (Fig. 2).

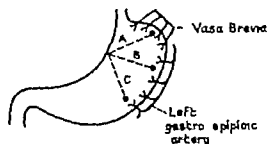


Fig. 1 (Vick) Levels of section in different types of gastrectomy in relation to the blood supply. A Measured radical gastrectomy. B two-thirds to three-quarters gastrectomy. C half to two-thirds gastrectomy.

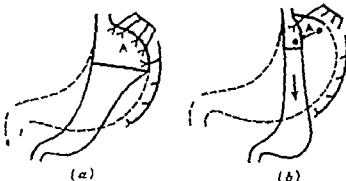


Fig. 2 Effect of division of the blood vessels supplying stomach. a, in two-thirds to three-quarters gastrectomy point A remains anchored against the hilum of the spleen. b, in measured radical gastrectomy after division of the vasa brevia, point A falls away from the spleen and presents in the wound. Note change in the shape of the stomach after division of the blood vessels.

The operative mortality for the last 430 operations was only 3.7 per cent. Of the 430 patients examined from 6 months to 12 years after operation, 95.1 per cent showed satisfactory results. The year-by-year continuous follow-up indicates that results improve with time, provided the follow-up is intensive. Every patient is seen at monthly intervals for the first 6 months, after which he is transferred to the gastric follow-up clinic, where he is seen by appointment every 6 months.

No case of macrocytic anemia was noted despite the extensive radical resection performed. No ulcer was found to recur later than 28 months after operation. In dealing with recurrent ulcer it should be discussed in precise terms—the exact extent of resection, the time that has elapsed since operation, and the type of ulcer for which the operation was planned.

EDWARD F. LEWISON, M.D.

Peptic Ulcer in the Aged. HENRY A. RAFFKEY, MICHAEL WEINGARTEN, and CHARLES I. KREIGER. *J. Am. Med. Ass.*, 1948, 136: 759.

In a series of 1,800 successive patients admitted to the hospital for peptic ulcer, 81, or 4.5 per cent, had no symptoms referable to the ulcer prior to reaching the age of 60. Fifty-eight per cent of the 81 patients had complications of ulcer on admission. Hemorrhage was the chief complaint in 38 per cent of the

**cases** The mortality from hemorrhage in this series was 10.7 per cent. No case of bleeding was treated surgically. Liberal use of slowly administered infusions and transfusions is advocated, when necessary in the treatment of hemorrhage due to ulcer in the aged. Hypertension is not a contraindication to these measures.

Perforation was the initial evidence of ulcer in 13.8 per cent of the cases and the mortality as a result of this complication is high. Pyloric obstruction due to ulcer in the aged often yields to medical treatment. Surgical treatment is imperative in those cases in which the obstruction is refractory to medical therapy.

Complicating diseases play an important role in the prognosis of ulcer in elderly patients.

SAMUEL KAHN M.D.

**End Results in the Treatment of Peptic Ulcer by Posterior Gastroenterostomy** WILLIAM A. COOPER. *Surgery* 94:5, 23, 4, 5.

The end-results in the treatment of peptic ulcer by posterior gastroenterostomy have probably never been accurately judged in the past. The purpose of this report was not to compare the results of gastroenterostomy and gastric resection, but to give as complete and clear a picture as possible of what one can expect from the older procedure gastroenterostomy. Unless vagotomy clearly proves to be the panacea that all those interested in this field have long looked for, there is reason to believe that the evaluation of gastric operations will be further beclouded. This is particularly true if vagotomy is to be used simultaneously with gastroenterostomy or resection.

The author utilizes his own method of statistical analysis involving the plotting of a failure curve. An analysis is made of poor results from the standpoint of pathology, clinical symptoms, correlation of symptoms before and after gastroenterostomy, diagnostic value of roentgenology and gastroscopy, factors influencing end results, results in age groups, results in nationality groups, results in clinical groups, and results in gastric ulcers. Furthermore an analysis is made of the results of treatment in failures. This is done from the standpoint of results of conservative treatment and of operative treatment.

It became apparent from the failure curve plotted by the author that one can expect about 25 per cent of patients after gastroenterostomy to have recurrent symptoms, usually within 5 years after operation and that about one-quarter of these will eventually become well without further surgery. From the pathology found in the patients in whom the operation failed it is clear that if the recurrent symptoms are persistent they will in all probability be due to a marginal ulcer rather than to reactivation or persistence of the primary ulcer. Since most of the primary ulcers in this series healed after gastroenterostomy it would appear that the procedure was a very effective method of dealing

with the primary lesion. It would seem that much of the talk one hears about reactivation of duodenal lesions after gastroenterostomy is fallacious. Indeed, one is led to the general conclusion that if the gastroenterostomy functions, the primary duodenal ulcer will heal whether it be an obstructing ulcer or a penetrating ulcer or a bleeding ulcer. The only exception in this series was one in which the stoma functioned poorly. The only other exceptions (not in this series) occurred late, when involvement of the stoma by marginal ulcer led to poor function of the stoma and consequent reactivation of the original duodenal ulcer.

Effective as gastroenterostomy may be for the treatment of primary ulcer it is perfectly clear that it often fails to prevent the formation of new ulcers; thus it fails to interrupt the ulcer diathesis. The impression exists that gastric resection is more effective than gastroenterostomy in this regard, but it is well known that resection also fails in certain cases. From the analysis of the secondary operations done it is apparent that certain patients have such a marked ulcer diathesis that they do poorly with both gastroenterostomy and resection.

It is probably accurate to state that most of the surgeons in this country have come to believe that gastroenterostomy is an inadequate and poor operation. In the light of experience in the present series this view is open to some question. Until vagotomy has been evaluated the alternative to gastroenterostomy is usually gastric resection. Had resection been attempted on all patients, the author believes the mortality would have been high. If not formidable, particularly in the group selected for gastroenterostomy since 1930, for among them were the poor risks.

A comparative evaluation of gastroenterostomy will have to await the completion of similar studies of end-results in gastric resection but the low mortality and generally favorable outlook reflected in the failure curves strongly support the view that gastroenterostomy is a useful and often curative procedure which has a definite place in the repertoire of gastric surgery. It may be that the passage of time and accumulation of experience will show that gastroenterostomy supplemented by vagotomy in cases in which it fails, will give the lowest mortality and the highest incidence of cures.

HAROLD LAUTMAN M.D.

**Late Results following Perforated Peptic Ulcer** S. W. MOORE and ROBERT HENDERSON. *Surgery* 94:5, 3, 442.

The authors' study was undertaken to determine the end results in patients with perforated peptic ulcers operated upon in Bellevue Hospital Second Surgical Division (Cornell). The cases of 101 patients who were treated on this service from 1928 to 1945 for perforated peptic ulcer are reviewed and the results of follow-up studies are presented.

From a statistical analysis based on a careful breakdown of the various factors involved the authors have drawn the following conclusions:

Patients with perforated ulcers should be operated upon promptly. The perforation should be closed by simple suture when simple suture causes obstruction. It should be combined with gastroenterostomy. No drainage is employed in the abdominal wound. Patients who have persistent symptoms or who have an active ulcer (or both) at 6 months after operation, and while on adequate medical treatment, should have additional operative treatment.

Secondary operations were carried out in 17 cases for reoperation hemorrhage obstruction or intractable pain. It is quite clear that although the immediate results of surgery for perforated ulcer are good, the late results as determined by follow-up studies are poor. The answer to this problem does not lie apparently in altering the initial operative technique. An analysis of cases showed that simple closure is still the procedure of choice except when the closure results in obstruction.

HAROLD LAUFMAN, M.D.

#### Duodenal Ulcer MAURICE FELDMAN, *J Am M* (11) 1948 136 736

A comparative statistical study of duodenal ulceration in the civilian population was made of two 5 year periods: the prewar period (from 1937 to 1941) and the period during the war (from 1942 to 1946) to determine the effect of the war on duodenal ulceration.

There was a rising trend in the incidence of duodenal ulcer during and immediately after the war. This amounted to about 4 per cent. The comparison of the age and sex incidence in duodenal ulcers between the prewar and postwar periods showed no significant statistical change. There was a slight increase in the incidence of cases of less than one year's duration in the second 5 year period. There was a slight increase in the number of ulcer niches observed by roentgenography in the wartime cases as well as a slight increase in the number of niches occurring in females in the war group.

During the war period there was a higher incidence of first recurrences and an increase in the incidence of acute ulcers. In many instances the severity of symptoms seemed to be more pronounced during the war period because of the increased number of acute ulcers.

The complication obstructive and hemorrhage were not statistically different in the two groups of cases. There was a greater incidence of hematemesis in females during the war period.

SAMUEL FARR, M.D.

#### Effect of Intestinal Gases upon Balloons of Intestinal Decompression Tubes. MARY O. CANNON, FREDERICK R. PHILLIPS and FREDERICK H. LUND, *Am J S* 1948 75 445

Experiments were conducted to study the permeability of intestinal gases through the wall of balloons of the various intestinal tubes. It was found that all balloons of intestinal decompression tubes are permeable to intestinal gases. Carbon dioxide and

hydrogen sulfide are the gases most likely to diffuse into the balloons of intestinal decompression tubes because of their high degree of diffusibility and because of the markedly higher concentration of these gases within the bowel as compared with their concentration within the balloon.

The authors describe their method of preventing gases from accumulating in the balloons of intestinal tubes which consists in applying the tie to the balloon in such a fashion that the mercury remains trapped within the balloon but air can enter and leave. In addition they urge that all balloons be made of neoprene-G. This type of rubber is only 19 per cent as permeable to carbon dioxide as is latex rubber. By these two changes the authors claim to prevent any accumulation of intestinal gases within the balloon.

Prolonged soaking of the balloon in intestinal secretions does not increase its permeability; neither does the presence of mercury within the balloon for long periods of time increase its permeability.

HAROLD LAUFMAN, M.D.

#### Cicatrizizing Intestinal Tuberculosis and Regional Enteritis. A. R. LINDER, *Ann chir gyn fenn* 1947 36 219.

This study is concerned with the relation hip between so-called hyperplastic or stenosing intestinal tuberculosis and regional enteritis. The cases discussed were observed between 1908 and 1937 at Surgical Clinic I, Helsinki, and included 29 patients treated by resection, 15 treated by short-circuiting and 1 patient treated by enteroplasty. The last 16 cases were not confirmed by microscopic section and are excluded. Twenty-six cases were studied by careful microscopy.

Tuberculosis was found in only 19 (65%) of this group of cases. In 5 cases a nontuberculous enteritis was found and in 2 cases respectively a carcinoma of the rectum and a sarcoma of the ileum. During the last decade no resections for intestinal tuberculosis have been performed.

Intestinal tuberculosis of the hyperplastic type is very rare (6%). The stenosing type of nontuberculous enteritis was found to be even more rare by the author although other authorities have described it as more common than the tuberculous type.

In most of the cases of hyperplastic intestinal tuberculosis the lesion appeared to be an isolated primary form of the disease as pulmonary tuberculosis was rarely diagnosed. The intestinal lesion was in the terminal ileum and cecum in 1 of 20 cases. The regional lymph nodes were also involved. When the cecum was involved the specimen usually conveyed the impression of a tumor. Strictures and ulcers were noted in various cases. Tubercles and increased connective tissue were typical findings. Ulcers in the ileum tended to penetrate through to the serosa while in the cecum they were usually superficial.

In the cases of nontuberculous enteritis a marked diffuse thickening was present as a result of deep

plasma cell and lymphocytic infiltration. The lesions were sharply delimited at the ileocecal valve. The peritoneum was thickened and bands were frequently present which made the bowel very tortuous. Cell conglomeration suggestive of tuberculosis and giant cells of the Langhans type were never observed in these cases. Small ulcers located at the mesenteric attachment were typical as were fistula formations and scars.

The pathogenesis of intestinal tuberculosis probably occurs through the lumen and in many cases a pulmonary focus was found as the primary lesion. The pathogenesis of regional ileitis appears to initiate from within the submucosa of the bowel.

Twenty three patients with intestinal tuberculosis were treated by surgical intervention and in 16 an ileocecal resection was performed. The resection mortality was 45 per cent. Of the 11 patients discharged 4 died many years and the remaining 7 died in from 2 to 5 months of tuberculosis.

The patients with nontuberculous enteritis were also treated by resection, but no mortality resulted.

E. VERT D. BLOOMENTHAL, M.D.

**The Sigmoid as a Source of Right-Sided Symptoms.**  
ALB. T. S. LYONS. *Ann. Surg.* 94:8 27 395.

The author cites 18 cases to demonstrate the frequency with which the sigmoid may be the cause of right-sided abdominal symptoms. The commonest preoperative diagnosis in these instances is acute appendicitis.

In the author's experience the principal causes for right-sided symptomatology resulting from sigmoid lesions are diverticulitis and carcinoma. Reasons for this clinical picture are the sigmoid lies on the right side of the abdomen as a result of its mobility, or anatomical variations in its course perforation of the right wall of the sigmoid, with spillage of exudate into the right iliac fossa, extension of a perisigmoidal abscess to the right, adherence of right-sided structures to the sigmoidal lesion, marked distention of the cecum and situs in situs.

The suggestion is made that inspection of the sigmoid should be included with the exploration of the abdomen before removal of the appendix when at operation insufficient cause for the clinical findings is discovered in the right iliac fossa.

HAROLD LATFMAN, M.D.

**Hirschsprung's Disease.** J. A. JENKINS. *Austral. N. Zealand J. Surg.* 94:8, 7 89.

Three cases of Hirschsprung's disease are described with a view to adding information to the subject. In 2 cases of abdominal distension in which spinal anesthesia did not effectively evacuate the colon, partial bilateral sphincterectomy caused daily adequate bowel motions with the aid of ingested paraffin. In one of these the sigmoid colon also was resected. The third patient was benefited but little after bilateral sphincterectomy and eventually died of massive collapse of the lung following resection of the colon and left lumbar sympathectomy.

The operative technique for partial bilateral sphincterectomy is described and illustrated. A wedge of the internal anal sphincter is removed bilaterally. No sutures are placed.

The nervous physiology of the colon and external anal sphincter is discussed. The rationale of lumbar sympathectomy is based on the belief that the sympathetic nerves are motor to the sphincter and inhibitory to the rectum and colon and the parasympathetic nerves are inhibitory to the sphincter and motor to the rectum and colon. A mass of contrary evidence is cited particularly the facts that low spinal anesthesia abolishes sphincter tone and that presacral neurectomy does not.

The nervous control of the colon in Hirschsprung's disease is discussed. Most authors postulate an inhibitory action on the colon by the thoracolumbar sympathetic outflow. A failure of development of the defecation reflex might result in hypertrophy and spasm of the internal anal sphincter and a diminution of sensory activity of the colon.

Following full radiological investigation, the induction of high spinal anesthesia is the first line of attack. It may prove effective therapeutically and also may indicate sympathectomy. Next bilateral partial sphincterectomy should be performed. All patients with gross dilatation of the pelvic colon should have this loop resected by a Mikulicz-Paul type of operation but only after thoracic development has been improved. If recovery is not then complete right lumbar sympathectomy may be indicated.

ERNEST D. BLOOMENTHAL, M.D.

**Cancer of the Rectum.** E. J. BORGES. *Ind. J. Surg.* 94:7 6.

One hundred and thirteen cases admitted in a 55 year period to the Tata Memorial Hospital in Bombay, India, are discussed. The ages of the patients varied from 17 to 85, the largest number of patients being in the fifth and sixth decades. Males predominated at a rate of 3 to 1.

Cancer arising in a polyp occurred only once and then in a European woman. It is the author's opinion that rectal polyposis is infrequent in India.

Diagnosis was made by means of digital examination, barium enema proctoscopy and biopsy. The neglect of digital examination is cited as the chief cause for delay in admitting the patient to the hospital for surgery.

The histological types encountered were adenocarcinoma in 43, squamous carcinoma in 33, adenoma malignum in 6, colloid carcinoma in 4, and myosarcoma in 1. There was a much higher incidence of squamous carcinoma here, than in Europe and America (Bacon 6% and Gabriel 35%).

The prognosis was adequately forecast by the Dukes classification as group A (within the rectal wall) yielded 84 per cent of cures, group B (penetration into the perirectal tissues) yielded 62 per cent of cures, and group C yielded 3 per cent of cures. The histological character of the lesion indicated the fate of the patient to a lesser extent but grades 3

and 4 lesions and colloid cancers were apt to be disseminated early and widely.

The Lahey two-stage operation was used early but was superseded in the latter part of the group by the Miles one-stage operation because of its greater acceptability to the patient, less chance for complications and the lack of adhesions. The two-stage operation is now used only in debilitated patients with obstruction, inflammation or both.

Radium and x rays were used palliatively when the patient was unfit for surgery or the lesion inoperable. Results were better in squamous cell carcinoma than in adenocarcinoma.

Preoperative preparation consisted of tests for blood counts, blood protein, nonprotein nitrogen, sugar estimations, urinalysis, cardiac efficiency tests with correction of the deficiencies. Purgation was avoided and two enemas given the day before surgery cleared the bowel adequately. When complete obstruction was present daily enemas and small doses of magnesium sulfate were used. General anesthesia was used in preference to spinal anesthesia in most cases because of its greater duration.

Thirty radical resections were performed with mortality in 3 cases. One death occurred among 10 patients subjected to the Miles operation and 2 deaths occurred among 9 patients subjected to the two-stage Lahey operation. Eight perineal excisions (used when the condition of the patient was not suitable for radical resection), 1 perineoabdominal operation, 1 Hartman operation and 1 Babcock operation resulted in no mortalities. Twelve of the 30 patients are dead, one could not be traced. Seventeen are alive from 1 to 5 years after operation.

The author prefers the one-stage abdominoperineal operation but also used Miles technique except that he used a left incision instead of a right and brought the colostomy out through the incision.

Postoperative treatment entails necessary infusions and an indwelling catheter for the first 48 hours. The perineal pack is removed after from 24 to 48 hours postoperatively. Complications were few, the most frequent urinary sepsis, occurring 9 times.

The author is intrigued by Babcock's operation for preservation of the sphincter but fears that it may prevent the most radical extirpation of the cancer.

EXTENT D. BLOOMER, M.D.  
**Resection of the Rectum with Preservation of the Anal Sphincter** WILLIAM F. NICKEL, JR., and ARTHUR I. CHENOWETH. *Surgery* 1948 23: 480.

The highly controversial question of resection of the rectum for rectal cancer, with preservation of the anal sphincters, is reviewed by the authors and 68 cases are analyzed. Sixty-one patients were operated upon 5 years or more before publication of the present article. Of these 62 per cent survived for a period of 3 years, 40 per cent survived for a period of 5 years and 26 per cent survived for a period of 10 years.

The authors state that it would be futile to go to great lengths to preserve the anal sphincters if after their preservation, they failed to function. In analyzing the functional results of this group of patients the authors were very strict in making their assessment in a sincere desire to judge the efficacy of the technique. Excluding the cases which could not be followed up and those which resulted in death, there were 34 cases suitable for evaluation from the standpoint of the reconstructed anal outlet.

Results were evaluated as follows: (1) perfect in dictating normal control regardless of consistency of stools, no staining and the presence of a sphincter which on examination contracts normally; (2) good indicating control of bowels with no soilage except under unusual circumstances such as an episode of diarrhea or following the use of a laxative—a few patients in this group have rather tight structures two requiring occasional dilatation; (3) fair these patients must wear a perineal pad at all times because of unpredictable accidents, they have control of the bulk of the stool but there is a slight leak or staining on frequent occasions for this reason they are insecure without a pad; (4) poor in this category are carried those patients who have what amounts to stools no sphincter and who have what amounts to a perineal colostomy. As judged by these standards the results were perfect 3 good 7 fair 10 poor 14.

The opponents of preservation of the anal sphincters firmly believe there is no place for such a procedure in the attack on cancer. Their arguments are based on the assumption that such an operation cannot be sufficiently radical. If it is assumed from recent observations that lymphatic extension does not in general occur laterally along the levators or downward toward the skin and sphincters, there remains only the question of whether it is possible to secure a resection sufficiently high to remove involved nodes in the mesosigmoid. Whether or not it can be accomplished is determined by several anatomical variables. These variables can be judged only at the operating table with the abdomen open.

The authors' belief based upon experience with this series and the investigations of others is that such a procedure is applicable only to lesions whose lower margin is at least 6 cm. above the anal orifice and whose upper limit is at or below the peritoneal reflection. When the lesions are restricted within this field, favorable results may be expected. If however enthusiasm for the procedure influences one to stretch the indications, the value of the operation becomes lost. Even in patients who are required to wear a perineal pad, the pursuance of daily activities is probably easier than for others with abdominal colostomies.

Thus it is believed that if cases are properly selected the operation of abdominoperineal resection can be carried out and the anal sphincters preserved without jeopardizing the patient's chances of survival and with a very good chance of providing him with a functioning anal outlet.

HAROLD LAUFMAN, M.D.

# LIVER, GALL BLADDER, PANCREAS, AND SPLEEN

**Actinomycosis of the Liver with Recovery** L. M. SNOOK. *Lancet* Lond. 1918, 1: 439.

The author states that no recovery from actinomycosis of the liver was recorded before 1914 and that few recoveries have been reported since that time. He cites a detailed history of a 40-year-old male patient who was saved through persistent and thorough treatment.

The patient had a 2 months' history of abdominal pain following an appendectomy. This prompted the performance of a laparotomy which disclosed actinomycosis of the liver. Within a period of 6 months an abscess developed in the abdominal wall and eventually there were numerous discharging sinuses. He had local and systemic penicillin therapy but on admission to the hospital a year after the laparotomy his condition was very serious.

A threefold method of attack was instituted. Surgical treatment consisted of free drainage. Medical treatment consisted of blood transfusion, penicillin, sulfathiazol, potassium iodide, and vaccine therapy. Radiotherapy included both radium and deep roentgen therapy. The latter was found to be the more practical. This strenuous therapy required 9 months but the patient made an apparent complete recovery and returned to school.

D. L. KUPP, M.D.

**Serum Proteins in Hepatic Disease** JAMES A. D. URMINEK and W. R. CAMPBELL. *Med. Clin. N. Amer.* 94: 3: 455.

With use of the sodium sulfate salting-out technique for the separation of serum protein fractions as devised by Campbell and Hann, the authors demonstrate that characteristic disturbances occur in the serum protein of patients who have parenchymal diseases of the liver. By this means not only are the serum proteins separated into the recognized fractions, albumin, pseudoglobulin, and euglobulin, but the presence in certain cases of an abnormal fraction, probably a globulin, is recognized. This abnormal globulin which is not present in normal serum is precipitated by addition of 13.5 per cent sodium sulfate. The authors have been particularly interested in this fraction and, for lack of a better name, refer to it as the "3.5 per cent fraction."

The normal average value of serum albumin is 5 gm. per 100 c.c. and of serum globulin just under 3 gm. per 100 c.c. The globulin fraction is divided into pseudoglobulin and  $\gamma$  which amounts to an average of 1.1 per cent and the euglobulin fraction which varies from 0.6 to 1 per cent.

The serum protein disturbance is characterized by a rise in the serum globulin and by a more or less corresponding fall in serum albumin. The rise in serum globulin is largely accounted for by an increase in the euglobulin fraction; the pseudoglobulins being only mildly elevated. The elevation of the euglobulin fraction above normal is almost entirely due to the

appearance of the abnormal 13.5 per cent fraction, which may amount to 1 gm. or more per 100 c.c. in most cases of cirrhosis. The presence of this 13.5 per cent fraction in any quantity is abnormal.

This disturbance in the serum protein picture is much more marked in patients with diseases which affect primarily the parenchymal cells than it is in those in whom the hepatic symptoms are associated with other causes, such as invasion with secondary neoplasm or biliary tract obstruction. In acute hepatitis the disturbance is relatively mild; in the Laennec type of cirrhosis the abnormalities may be more pronounced. In the late cachectic stages of cirrhosis, however, all protein fractions are decreased.

A striking change in serum globulin was found in patients suffering from the various forms of extrahepatic jaundice or from secondary carcinoma of the liver, but in the patients with carcinoma a decided fall in serum albumin level was a frequent finding. These findings of hypoalbuminemia, hyperglobulinemia, and the presence of the "13.5 per cent fraction" may assist one in arriving at a diagnosis of cirrhosis of the liver. LAY ELLIOTT LAY, M.D.

**Diseases of the Pancreas.** K. J. R. WICHMAN. *Med. Clin. N. Amer.* 1918, 32: 518.

The anatomical features that must be borne in mind in discussing diseases of the pancreas are its relationships to the peritoneum, the bile duct, the duodenum, the splenic vein, the mesenteric vessels, the renal apparatus, and the celiac plexus. The peritoneum covers the body and tail of the pancreas and is separated from the head by the duodenum and root of the mesentery, thus allowing inflammatory or neoplastic processes of the tail and body to become disseminated throughout the peritoneal cavity while those in the head involve the duodenum or bile ducts by compression or extension. Due to the intimate relationship of the pancreas to the celiac plexus and the somatic nerves of the posterior body wall, pain is a common and early symptom of all pancreatic diseases although there is no uniformity in character or distribution other than a tendency to be constant, boring, and to radiate to the back. In so per cent of people the pancreatic duct and bile duct are completely separate, in 12 per cent they form a common channel of significant length, and in the remainder the ducts join together in such a way that simultaneous obstruction of both may occur with little possibility of producing a common channel to allow reflux or secretion from one to the other. The lymphatic drainage of the head is to subpyloric lymph nodes while the body and tail drain to nodes along the borders of the gland.

The pancreatic juice is secreted at a variable rate and with a variable content of enzymes, and is greatest in amount in 2 to 3 hours after meals. The amount of secretion appears to be in excess of the requirement, for a very gross reduction is necessary before symptoms of pancreatic insufficiency are produced. Experimental obstruction of the pancreatic duct causes a rise in blood amylase and lipase content.

The pathological reaction of the pancreas in acute affections of various kinds is rendered uniform by the activation of trypsinogen and the subsequent digestion of tissues producing edema, necrosis and hemorrhage. The condition may then become self-perpetuating and progressive even if the original stimulus has been removed. The fundamental problem appears to be the means whereby trypsinogen becomes activated to form trypsin—what this means is has not been found. The amount of damage produced depends on the volume of juice which escapes, the concentration of enzymes in the juice and the number of large blood vessels with which it happens to come in contact. The damage may range from transient edema to massive necrosis. Progress may be continuous or intermittent and may become arrested at any stage. Secondary infection may supervene producing a suppurative process which may lead to abscess formation. The necrotic tissue may liquefy giving rise to pseudocysts. In the absence of any of these complications the necrotic tissue is removed, there is some regeneration of acinar tissue but a certain amount of fibrosis always takes place. Extreme fibrosis with reduction in the amount of glandular tissue, distortion of the ducts and the formation of cysts characterizes the condition known as chronic pancreatitis.

Calcification within the gland substance or ducts is a common late sequel. Chronic pancreatitis may be produced as a result of repeated attacks of acute pancreatitis or may be due to a steady progressive lesion. Cholelithiasis occurs in more than 50 per cent of patients with pancreatic disease as compared with an incidence of from 10 to 20 per cent in normal people of comparable age groups.

The syndrome of surgical shock which occurs in some cases of pancreatic necrosis is probably due to the presence of autolyzed tissue in the retroperitoneal space, and partly by reflex disturbances mediated through the numerous nerves in this region. The syndrome of chronic pancreatic insufficiency which is rare is characterized by fatty diarrhea, malnutrition and weakness, hypotension, hypoproteinemia, glossitis, clubbing of the fingers, vitamins D and K deficiency and disturbances in electrolyte metabolism. The best criterion of excessive fat loss is the demonstration that the daily total excretion of fat exceeds 20 per cent of the dietary intake.

The serum amylase test is of value when acute damage to the pancreas has been produced. There is a rapid rise within a few hours and a fall again to normal in 24 to 48 hours. In chronic disease the serum amylase is usually normal.

Acute pancreatitis occurs in a wider age spread than is commonly believed, obesity is not necessarily present, and the sex distribution is impartial. The subjective characteristics of the attack are variable, pain ranging from agonizing and steady to mild and remitting. The syndrome of shock which is traditionally associated with this illness is absent twice as frequently as it is present. The presenting picture on physical examination varies from the complete

picture of peritoneal inflammation with vomiting and distention to mild abdominal complaints. Laboratory findings too are variable although the white count is nearly always elevated. Serum chloides are usually low and the finding of albumin in the urine is common. Recent workers have noted a lowering of the calcium, protein and prothrombin content of the blood during an acute attack. The serum amylase is elevated for 12 to 48 hours and then falls. If the diagnosis is made with certainty these patients are not operated upon and in those who are operated upon, closure is accomplished without drainage or interference with the biliary tree unless there was an indication for doing one of these things. Medical measures include gastric suction, the administration of saline and glucose intravenously, transfusions of blood and plasma with sedation as required.

There is a group of patients who may be seen repeatedly with what appears to be attacks of acute pancreatitis. This condition, recurrent pancreatitis, is characterized by the development of a chronic lesion of increasing severity. In the intervals between attacks the patient is well or may complain of dyspepsia. Cystic changes and calcification occur with the development of the syndrome of pancreatic insufficiency. Occasionally pancreatic lithiasis develops.

Pancreatic insufficiency may occur in infancy. This syndrome of congenital fibrocystic disease appears to be congenital and even familial. The infant soon dies of malnutrition. If not he develops pulmonary infection with fibrosis, bronchiectasis and patchy atelectasis and dies before the teens are reached. Examination of the pancreas shows the acinar tissue to be replaced by fibrous tissue or fat. Treatment is the same as in adult insufficiency.

True cysts of the pancreas are rare. They may be neoplastic, or may be a collection of fluid which develops following acute pancreatic necrosis. This cyst has no epithelial lining and therefore is spoken of as a pseudocyst. Its fluid contains altered blood and pancreatic enzyme. The symptoms vary but examination usually reveals the presence of a cystic mass in the abdomen. The treatment is surgical and usually consists of evacuation and marsupialization. Excision of the cyst is attended by a higher mortality, frequently followed by the formation of an external fistula. The loss of pancreatic fluid via a fistula may cause a marked disturbance of electrolytes leading to impairment of renal function with nitrogen retention. Surgical therapy tends to be disappointing and should not be undertaken until the fistula has been given every opportunity to close spontaneously.

Carcinoma may arise from the acini, the ducts or (rarely) the islet tissue. The symptoms are largely determined by anatomic factors and show considerable variation. Pain and jaundice are the two most common symptoms. The tumor most commonly arises from the head of the pancreas. Carcinoma arising from the body and tail tends to become more widely disseminated. Curative therapy does not yet



appear to be within reach although advances are being made in the field of radical surgery. In patients in whom itching becomes intolerable a short circuiting operation should be considered.

FLY ELLIOTT LAFARUS M.D.

**Observations in Pancreatic Surgery. Acute Hemorrhagic Cystic, and Pseudocystic Pancreatitis. (Observazioni di chirurgia pancreatica. Pancreatiti acuta emorragica, cistica, pseudocistica)** MATTEO BERALTI. *Arch Ital Chir* 947 69 44

The author presents 5 case reports of varying forms of pancreatitis. The first, diagnosed perforated peptic ulcer was found to be an acute hemorrhagic pancreatitis. Cure tamponade and partial closure of the wound resulted in improvement. The wound closing on the seventh day by second intention after the tamponade was removed.

In the second case, tumor of the size of an adult head was noted in the left hypochondrium. This was diagnosed as a sacculated peritonitis following perforated ulcer. At operation a large cyst contained 1,000 c.c. of hemorrhagic serous fluid was found. This was aspirated and drained by means of rubber tube. Drainage ceased after a period of months.

After several days of pain and vomiting the third patient was found to have palpable mass in the epigastric region about the size of a fetal head at term. Radiologic examination revealed extrinsic pressure along the greater curvature of the stomach by the palpable mass. The preoperative diagnosis of pancreatic cyst was confirmed at operation. The cyst was marsupialized with gauze packing. The wound was completely healed in a month.

The fourth case occurred in a patient who received an injury resulting in three fractured ribs. This was followed by abdominal pain and vomiting which persisted. The patient lost about 12 kgm. in a month. A mass was palpable in the epigastric region but did not move with respiration and the stomach was displaced to the left by a mass compressing the lesser curvature and lying relatively tenuous. These findings were made by means of roentgenography. A probable diagnosis of pancreatic cyst was made which was confirmed at operation. The cyst contained about 1 liter of yellowish fluid. A part of the cyst was resected. The residual sac was then sutured to the lesser omentum and the parietal peritoneum and the cavity was packed with gauze. The condition of the patient, which was poor before operation, became worse and death occurred on the third day.

The fifth patient had been having epigastric distress for 5 years. Examination revealed a large mass in the right hypochondrium, which moved with respiration. Roentgenograms revealed the tumor to be probably pancreatic in origin. At operation a retroperitoneal tumor covered by a gastrophrenic ligament and voluminous veins was found. About 650 c.c. of milky fluid were aspirated. An attempt at enucleation of the cyst proved unsuccessful and it was then marsupialized the edges being sutured to

the parietal peritoneum. The drainage ceased after 40 days when the wound was almost healed.

The author reviews the literature on the subject and brings out that in the early cases early operation is considered the essential element of success. According to the statistics of Linder (1917) of cases in which intervention was late the mortality was 62.5 per cent and in cases in which it was early the mortality was 13.5 per cent.

When biliary calculi are found cholecystostomy is a livable in order to prevent bile reflux into the canal of Wirsung.

In 4 of the cases external drainage was used. The author classified these as one of prepancreatic cystic hematoma, 2 of pseudocyst and 1 of true cyst of the pancreas.

The question of internal drainage as advocated by some authors is discussed. The conclusion is establishing a communication between the cyst and the digestive tube. It is advocated in order to prevent the development of persistent fistula so often encountered when cysts are marsupialized. The reason why some cases heal and others form a fistula is explained by Okincsev. The cyst which do not have a communication with the pancreas at the time of operation go on to heal whereas those which still have a communication with the duct of Wirsung or its large tributaries will form a fistula.

The author concludes that as a primary procedure internal drainage is not without danger as there may be complications because of technical difficulties, hemorrhage, insufficient drainage and secondary infection from the bowel. He advocates that the cysts be marsupialized and then, if a fistula should develop and refuses to heal internal drainage be performed by using the fistulous tract and anastomosing the cutaneous opening with an abdominal organ.

LEON J. FROSTEN M.D.

**Radical One-Stage Pancreaticoduodenectomy**  
CHARLES G. CHILDS, III *Surgery* 1943, 3 49

The purpose of this report is to review an operation for one-stage pancreaticoduodenectomy which proved satisfactory in a group of 22 patients operated upon at the New York Hospital during the past 6 years.

The author describes in detail his step-by-step technique for this procedure. The initial features of the operation are the maneuvers directed toward determining if possible whether or not the superior mesenteric vein is compromised by tumor. It can be hoped that eventually some successful method of avoiding the necessity of preserving this structure may be devised for it is certainly the weakest point, as well as the most frustrating, in the entire operative technique upon pancreatic cancers.

The author's technique is essentially that of Whipple. A choledochojejunostomy and a gastroduodenostomy distal to the biliary anastomosis is accomplished. With the use of this procedure the troublesome ascending cholangitis in the postoperative period is apparently avoided.

Reconstruction of the enteric canal is accomplished by retrocolic end-to-end pancreaticojejunostomy, retrocolic end-to-side choledochojejunostomy or simple implantation of the common duct into the jejunal lumen and antecolic long loop isoperistaltic gastrojejunostomy. As safety measures the retroperitoneal space, which it is impossible to reperitonize, is drained through a stab wound in the flank and a cholecystostomy tube is inserted through a separate stab wound just below the costal margin.

HAROLD LAUTMAN M D

**Total Pancreatectomy** EUGENE A. GASTON N  
*England J M* 1948 238 345

The author reports a case of diffuse carcinoma of the pancreas in which total pancreatectomy was performed and analyzes 16 similar cases reported in the literature. The surgical results and physiologic changes are discussed. In the present case the spleen, the pyloric antrum of the stomach, all of the duodenum, 15 cm. of the jejunum, the lower half of the common bile duct and the right half of the transverse colon were removed in addition to resection of the entire pancreas. In 17 cases in which total pancreatectomy was performed for all causes 7 patients survived the operation and 10 died an operative mortality of 59 per cent.

The diabetic state that follows total pancreatectomy in man appears to be relatively mild. A state of apparently increased sensitivity to insulin has been present during the early postoperative period in nearly all reported cases. These observations are of great importance in the management of patients after total pancreatectomy. Hypoglycemic reactions should be avoided and treatment should be directed more toward the prevention of ketosis than to the control of the blood sugar levels.

Although material concerning the effects of total pancreatectomy on the liver in man is scanty it is evident from this review that the gross fatty changes noted in depancreatized dogs have not been observed either clinically or at autopsy. Changes similar to those seen in the dog and responding to the administration of lipocaine have been observed in spontaneous diabetes and after destruction of the pancreas from repeated attacks of acute pancreatitis. Therefore it is unlikely that the failure to observe in man the liver changes noted in the dog is due to a species immunity although this factor must be considered. It is more probable that the presence of choline and other lipotropic substances in the diet of man is sufficient

to protect the liver. Because of poor fat digestion in the total absence of pancreatic secretion the stools tend to be bulky and frequent these changes being more marked the higher the fat content of the diet. For this reason the postoperative diet should be low in fat, the caloric intake being maintained with carbohydrates which are well tolerated. In addition pancreatin in doses of 15 gm daily should be administered to increase the absorption of fat and protein and to aid in the maintenance of nitrogen equilibrium.

JOHN L. LINDBQUIST M D

## MISCELLANEOUS

**Strangulated Obturator Hernia.** ANDREW M. DESMOND and FRANK HUTTER. *Brit J Surg.* 1948, 35 318.

Two cases of strangulated obturator hernia in which the correct diagnosis was made preoperatively are reported. The salient features which indicate the condition are a combination of acute intestinal obstruction with pain referred down the front and inner aspect of the thigh to the knee in an elderly wasted woman, tender swelling palpable on the lateral pelvic wall by rectal or vaginal examination, tenderness within Scarpa's triangle which may sometimes be associated with a fullness or a well-defined lump, maintenance of the limb in a semiflexed position and limitation of hip movements because of pain. Differentiation from femoral hernia depends upon the fact that the fingers may be pressed down on the pubic ramus above the lump without discomfort.

The importance of correct preoperative diagnosis lies in the advantage of the proper choice of operative approach. A lower midline incision with the patient in the Trendelenburg position provides quick and easy access to the sac without unnecessary manipulation. The strangulation is almost always of the Richter type so that gut resection is seldom necessary. A partial resection of the bowel wall or the turning in of an area of doubtful viability is all that is required in most cases. Whether or not the sac itself should be removed or some form of repair carried out depends largely upon the general condition of the patient. The authors believe that this should be limited to the minimum operative procedure and that removal of the sac only should be adequate. The intimate relation borne by the bladder to the neck of the sac is of importance.

JOHN L. LINDBQUIST M D

# GYNECOLOGY

## UTERUS

**Studies on the Histopathological Diagnosis in Biopsies of the Mucosa of the Corpus Uteri** (Considerazioni sulla diagnosi istopatologica nelle biopsie della mucosa del corpo dell'utero) I. CURVO. *Fel. gyn.*, Geneva, 1946, 41: 205.

The author discusses the physiological and pathological tenets as applied to the uterine mucosa, stating that with the advent of Opitz, Hirschmann, and Adler endometritis became an entity while the glandular form has been described as a functional state of the uterine mucosa. Some authorities however still believe that there are cases in which the glandular alterations are the result of inflammation and therefore this also must be considered an entity per se. To prove this, in 1910, he had E. Rossi study uterine scrapings. The latter came to the following conclusions:

1. The presence of plasmazellen may be of help in the anatomical diagnosis of inflammation but should not be credited with the importance given to it by Adler and Hirschmann.

2. Permanent changes of the uterine mucosa must be considered pathological.

3. In doubtful cases certain histological characteristics must be taken into account in addition to the anamnesis before it is concluded that the changes are due to menstrual modifications of the mucosa.

4. Glandular endometritis is an entity because of

- a. Changes as mentioned
- b. Its presence in women already in the menopause with steady bleeding for successive months.
- c. Changes concomitant with the inflammatory processes designated by the plasmazellen

The author states that these conclusions are true today if we add to them the dysfunction of the internal secretion of the follicle of the corpus luteum, and of the hypophysis as regulator of the menstrual cycle.

In 1909 Pankow suggested that uterine loss of blood may be due to ovarian dysfunction. R. Schroder explained how persistence of the ovarian follicles, by causing cystic hyperplasia of the glands of the uterine mucosa, led to uterine bleeding; while Keller described four types of uterine mucosa, namely (a) cystic glandular hyperplasia (b) atrophy of the mucosa (c) mucosa at rest and (d) glandular hyperplasia as in myoma.

The treatment as explained in the works of Kaufman and Giesen and pursued at the Gynecological Clinic of the Charité in Berlin (1940) corroborated the truth of the hypothesis of Pankow and Schroder.

This article is a review of uterine scrapings studied during 3 years for the purpose of correlating the morbid forms and histological changes in the uterine

mucosa. Cases of abortion were excluded. An accurate report of 401 cases with their clinical and histological data which the author studied is given. 198 cases presented characteristics of interstitial endometritis and 203 cases glandular hyperplasia. Among the latter he includes a few cases of uterine fibroma.

The author admits that the ovarian hormone plays an important role in the changes of the uterine mucosa. He discusses and confirms the work of Cova, stating that the uterine mucosa must be considered different from the mucosa of other tissues, and that the monthly desquamation and regeneration point to the existence of other stimuli, in addition to the action of hormones which favor glandular development or maintain the hypertrophy and hyperplasia caused by ovarian stimulation. According to the author this seems confirmed by his cases of fibromyomatosis in which the extensive glandular development conveyed the idea that he was dealing with cases of benign adenomas.

Menstrual cycle, menstruation, rupture of the follicle, and corpus luteum formation do coincide chronologically but only approximately. This is confirmed by Schickels (1921) Vignes (1929) and Hirschmann. Adler and Temervary, the latter reporting that in only 9 of 141 cases did the histological findings coincide with the phase of the menstrual cycle. The author emphasizes the fact that in the literature there is an abundance of cases in which menstruation occurred without the dehiscence of the follicle. His own cases are grouped as follows:

1. Changes observed in women already in the menopause. The study of the uterine mucosa of 137 women in the menopause and with amenorrhea ranging from 2 to 5 years in 67 cases from 5 to 10 years in 31, more than 10 years in 17 (2 women aged 80 and 87 years respectively being 40 years in the menopause) showed atrophy in 63 cases, moderate proliferation in 14, hyperplasia in 28 and retrogressive changes in 33. In 28 of the 43 cases with moderate proliferation and hyperplasia the mucosal changes had invaded the endometrium and the hyperplasia compared very well with that present in the age of fecundity. This supports the view of Novack, Yul and Vallart that the estrogenic function of the ovary may be observed in the advanced menopause and may be even reinforced by the estrogenic action of other glands of the genital chain.

2. Cases with polypoid formation of the uterine mucosa. According to Lahm polypoid formation is found only in women near the menopause and is due to altered ovarian function but according to the author, it may be found at any age. The polyps are not to be regarded as originating from residue of the canal of Gartner or Wolff or the duct of Mueller but as an aftermath of inflammation leading to tumefaction which gradually becomes a polyp.

3 Decidual endometritis, i.e. cases of postabortion endometritis in which abortion had not been reported or had taken place so long previously that no clinical relation existed between the two conditions. The endometritis must be regarded as due to chronic irritation leading to endometrial changes which become manifest in the mucosa and which are not exfoliated during menstruation. Hormonic influence and chronic irritation may cause them to proceed to polypoid formation.

4 Cases in which the glandular development is so extensive that adenomatous formation must be considered. The author states that the glandular hyperplasia caused by chronic inflammation may proceed beyond the stage of physiological menstruation and assume the traits of an adenoma, and at times may even lead to a polypoid formation.

5 Uterine fibromas and uterine fibromatosis. The author confirms the microscopic findings described by Wider in 1878 i.e. whenever the fibromatous node projects or is close to the uterine cavity the mucosa is atrophic, and when the fibromatous node is distant from the uterine cavity the mucosa contains many glands which have a tendency to infiltrate the uterine muscle.

The author states that the glandular hyperplasia may be due to hormonal action or to the stimulus causing the fibrous neoplasm. In the cases of fibromas he detected in the ovarian parenchyma constant sclerocystic changes and serous follicular cysts and these, he says, may influence the uterine mucosa and cause glandular changes. He advances the opinion that the fibromas may lead to malignant degeneration of the uterine mucosa and refers to a case he reported in 1946 in which a woman receiving x ray therapy for uterine fibromas developed an adenocarcinoma of the uterus. Another opinion he advances is that the dense hyperplasia and glandular hypertrophy must be considered a precancerous condition.

The menorrhagia and metrorrhagia are ascribed to prolonged follicular action which causes endometrial proliferation, glandular hyperplasia and capillary ectasia and to hyperactivity of the uterus which by causing hyperemia, will lead to metrorrhagia. The metrorrhagia in turn is enhanced by the lesser contractility of the uterus brought about by the presence of the nodules in the uterine parietes.

JOSEPH M. A. PAPP, M.D.

**The Treatment of Carcinoma of the Cervix with Radium and 800 Kilovolt X Rays.** HANNAH E. SCHMITZ. *Am J Obst* 1948, 55: 262

One hundred sixty-six cases of primary carcinoma of the cervix admitted to the Mercy Hospital Institute of Radiation Therapy, Chicago, during the 10 year period through 1945 are reported. The cases are grouped according to the Schmitz classification of four groups, and are microscopically graded according to Broder's division into four grades. All cell types are treated with roentgen rays and radium and the Wertheim operation is reserved for lesions that

are refractory to irradiation or that recur. None of the patients in this series were treated by subsequent surgery because of recurrence.

The method of combined radium and x ray therapy is described. An x ray dose of 4,000 roentgens in to the tumor and surrounding gland bearing areas is desired. Whenever possible, but one anterior and one posterior field is used this field being 20 by 20 cm or less depending on the size of the pelvis. No special effort is made to screen out vital structures as this practice invites error due to misdirection of the radiation beam. Radium therapy is carried on in conjunction with the roentgen therapy. A total dosage of 4,500 mgm. hours is administered through the cervical canal. Roentgen therapy is relied on entirely to destroy extension of the disease beyond the zone of effective radium rays.

A 5 year relative cure rate of 43.37 per cent is reported and compared to a previously reported rate of 28.00 per cent in a group in which similar radium therapy but lower voltage roentgen rays were used. The improvement is considered due to the higher voltage roentgen therapy in present usage.

The technique of radiation as described varies somewhat from the most widely accepted procedures because of the method of applying radium and x rays and the dosages used. This has helped to avoid the numerous complications of bowel, ureteral and bladder injury described in many clinics and given by some as a most important reason for returning to surgical treatment.

The microscopic grading of tumors is an aid in predicting the response to therapy but not in determining the type of treatment indicated. A localized tumor irrespective of its cell type should be irradiated as in most instances it will respond satisfactorily. If it proves to be resistant to this form of treatment surgery can be instituted and executed without increased difficulty.

Of all cases only 22.2 per cent were clearly operable. Salvage in the cases in groups I and II was 70 per cent at the end of 5 years and 55 per cent at 10 years. This is higher than for any comparable surgically treated group. It is the author's decision therefore to continue treating all cervix cancers with irradiation and to employ surgery for the conditions as stated.

JOHN R. WOLFE, M.D.

**The Evaluation of the Results of Carcinoma of the Cervix Uteri Treated by Radical Vaginal Operation.** SUBODH MITTA. *Am J Obst*, 1948, 55: 293

The rationale of the treatment of carcinoma of the cervix is still a controversial subject. Although the general trend of opinion is in favor of radiation therapy the surgical treatment still occupies a definite place in its management. An analysis of world statistics shows that whatever method is followed (operation or radiation) the end results are for all practical purposes the same in the hands of experts with a small percentage of variation.

The author began using the radical vaginal operation in 1932 supplemented by postoperative radia-

tion. Reasons for using this procedure instead of radical abdominal operation are given. Special points of technique are given in detail. Cases are classified according to the League of Nations formula. Materials for operation were taken not only from grades 1 and 2 but also from grade 3.

The report concerns 151 patients, 6 of whom died as a result of operation, the primary mortality being 3.8 per cent. The total number of patients operated upon between 1933 and 1940 was 93. Five year salvage cases totaled 35 i.e. a relative 5 year cure rate of 37.6 per cent. The cases are arranged in groups, with their corresponding survival rates, and the author compares these figures advantageously with similar groups treated in earlier years by radiation therapy.

The author states that as yet there is no remedy for advanced cases. Operable cases yield satisfactory results up to a certain limit whatever method is followed provided that treatment is given efficiently and with meticulous precision. It is only by the detection of early cases and the centralization of patients in special cancer clinics that we can markedly improve our end results and hence the right movement should be that of education of the lay public and special courses of training for general medical practitioners. JOHN R. WOLFF, M.D.

**Lat. Recurrence of Cervical Carcinoma following Radiation Therapy.** HAROLD SPERRY, M.D.  
Okl. 945 35 533.

More than one half of the patients with carcinoma of the cervix who have been unsuccessfully treated by irradiation at the Roosevelt Hospital, New York, showed a recurrence of their tumor within a year following treatment. The average interval between treatment and recurrence in 105 patients with recurrent epidermoid carcinoma of the cervix treated with radium was 14.5 months. Tumor recurrence after 5 years is distinctly unusual, only one occurring in the above group. This fact has served as the justification for the reporting of cervical cancer statistics in terms of 5 year cures. Most gynecologists consider patients completely cured who survive this period with no clinical evidence of the disease.

Cervical cancer does not always run so rapid a course however. New concepts of the pathology and biology of the early stages of the disease have been developed during recent years. Lesions which formerly were considered benign or of questionable malignancy have been associated with genuine cancer sufficiently often either by observation of the untreated patient during the ensuing years after biopsy or by more intensive examination of the original specimen to merit the diagnosis of cancer themselves.

The purpose of this communication is to record extraordinary cases which show that cervical carcinoma may progress slowly or perhaps even lie dormant for long periods after treatment by irradiation, during its later clinical stages. The case histories are given indicating local recurrence of previously treated

diated cervical cancer 17½ years and 19½ years later respectively.

The author concludes that from a practical clinical standpoint it would seem safe to consider as probably cured any patient with cervical cancer who survives the standard 5 year period without evidence of recurrence.

JOHN R. WOLFF, M.D.

#### ADNEXAL AND PERIUTERINE CONDITIONS

**Thecoma—Xanthomatoid Thecocellular Fibroma of the Ovary of Loeffler and Priesele—Mösenchymoma of the Ovary of Novak (Thecoma—fibroma thecocellulare xanthomatodes ovarii de Loeffler e Priesele)—mesenchimoma do ovário de Novak.** CÂNDIDO WATUKABE and ANTONIO NASARETH. A. Brasil. gin. 947 24 433.

The histogenesis of thecomas is not yet definitely established. Their incidence amounts to 2 or 3 per cent of the solid ovarian tumors, and over 70 per cent of them occur after the menopause. The appearance of metrorrhagia in this period associated with a palpable ovarian tumor and hyperplasia of the endometrium, suggests the presence of a tumor with hormonal activity.

The occurrence of metrorrhagia is nearly twice as frequent in the postmenopausal cases as in the cases encountered during the menopause. The presence of tumor before the menopause generally produces changes in the menstrual rhythm. Few patients complain of rapid abdominal enlargement due to the tumor however the tumor may cause signs of compression, intestinal occlusion, and an acute condition of the abdomen by torsion of its pedicle. Hyperplasia of the endometrium is present in 50 per cent of the cases and consists of thickening with polypoid aspect. The uterine body also increases in size, principally in the form of myomatous nodules. Amenorrhea is the most frequent symptom in young patients and may be primary or secondary, the latter form predominating. Sterility is less frequent. Development of breast atrophy, revivification of the vaginal mucosa, and even appearance of libido may be observed in menopausal cases. Association of adenocarcinoma of the endometrium and thecoma is relatively frequent. Virilization is rarely observed. Ascites and hydrothorax may be found.

The thecoma is always unilateral and usually on the left side. It has a predominantly estrogenic action. Macroscopically it has the aspect of a solid ovarian fibroma. Its surface is smooth or nodular of white-yellowish color with grayish tints and sometimes dark spots which are due to hemorrhagic foci. It is generally free from adhesions. Its size varies greatly. It may escape the most careful gynecologic examination but its average size is that of a hen's egg. Section reveals a yellowish or grayish surface composed of islets of varying size and enveloped by a fine capsule. Microscopically there are cords of large fusiform cells arranged irregularly, interlaced through the tumor, and separated by bundles of connective tissue of variable size. The cells have a rather indistinct membrane

and a well stained nucleus. Sudan III staining reveals characteristic intracellular fat and some extracellular fat globules, which are birefringent. In addition there are also large cells filled with lipid which are luteinized thecal cells. Silver impregnation shows the presence of a reticulum.

Thecomas are regarded as benign tumors but there are some which evolve in a malignant manner. However metastasis to neighboring or distant organs has not yet been observed. Clinical diagnosis of thecoma is difficult. Only histologic examination can furnish the correct diagnosis by revealing the presence of the intercellular reticulum and of birefringent fat. Treatment is always surgical: hysterectomy with bilateral salpingo-oophorectomy in women beyond or near the menopause or simple extirpation of the tumor with or without unilateral salpingo-oophorectomy in young women.

The authors report a case in a woman of 19 years who for about 2 months had diffuse abdominal pains, principally in the hypogastrium, and was suspected of being 3 months pregnant. A plain film of the abdomen did not reveal any shadows denoting pregnancy. In about 2 months she developed marked cachexia and an enormous ascites. Infraumbilical laparotomy disclosed a tumor which occupied the entire hypogastrium, extended into the right iliac fossa, and was easily removed. The condition of the patient was good on the eighth postoperative day but peritonitis developed suddenly and resulted in death. The tumor weighed 3 kgm. and consisted of various nodules of different size solidly grouped together and all having more or less the same aspect of yellowish color and firm consistency, some showing dark spots on their surface. The histologic diagnosis was tumor of the thecal and granulosa cells in which the first variety predominated over the second.

RICHARD KEMEL, M.D.

#### Malignant Tumors of the Ovary JOHN B. MONTGOMERY 4th J. Obst., 1948 55 301

This study consists of a brief review of all of the cases of malignant disease of the ovary that were treated in the Division of Gynecology of the Department of Obstetrics and Gynecology at the Jefferson Medical College Hospital, Philadelphia between October 1, 1921 and October 1, 1946. Of 107 cases 84 were primary carcinomas of the ovary and it is with this group that the article is chiefly concerned.

The cases were studied in the light of the four outstanding factors that generally are regarded as governing the end-results in ovarian carcinoma: the extent of the growth or the operability, the grade of malignancy, the histologic type of tumor and the influence of x-ray therapy on the lesion. Throughout the study when possible it is attempted to show the interrelationship of these factors.

A summary of the end results shows that the 5 year survivors amounted to 22 per cent of the entire group of patients which approximates the 30.5 per cent of survivors in the primary adenocarcinoma group.

Operability and grade of malignancy are undoubtedly the factors that govern the percentage of survivals for 5 or more years. So far as type goes the papillary cysts are the most favorable and if they are completely operable one may safely predict that at least 50 per cent of the patients with this condition will be alive and free from disease for more than 5 years. On the other hand the number of 5 year survivors among the patients who have actively malignant tumors, the partly cystic and partly solid type or the solid type is pitifully small. This result is influenced by the fact that the vast majority of such tumors do not come under observation until the growth is far advanced.

The difficulties in achieving an early diagnosis in carcinoma of the ovary seem almost insurmountable. Many are "silent" or nearly so. Yet in the present study 37 per cent of the patients had abdominal symptoms mostly referable to the gastrointestinal tract for from 6 months to several years before a pelvic examination was made.

If malignant disease is to be detected at an early stage in more than an occasional patient, routine periodic pelvic examinations will have to be carried out in large numbers of women supplemented at times by special studies and occasionally by an exploratory abdominal incision. The success of such a program will depend upon the ability and care of the family doctor as well as the gynecologist.

JOHN R. WOLFF, M.D.

#### Abdominal Contusion and Rupture of Pyosalpinx into the Free Peritoneal Cavity (Contusione addominale e rottura di piosalpinge in peritoneo libero) FRANCO LOBELLO *Riforma med.*, 1947 61 536

A case report of traumatic rupture of a pyosalpinx into the free peritoneal cavity is reported. This occurred in a 30 year old female who 2 months previously had had irregular treatment for blennorrhagia (gonorrhea). There were no intervening symptoms to indicate the possibility of salpingitis or pelvic peritonitis. She received a violent human kick in the hypogastric region during an altercation. This was followed by a violent pain in the lower abdomen followed by collapse. This pain persisted and was followed by vomiting. She was seen by a surgeon who noted the abdominal contusion with a normal temperature and slight muscle spasm and he decided to observe the patient. Next morning however she was brought to the hospital with a classical picture of diffuse peritonitis caused by perforation of a hollow viscus.

There was painful limited uterine mobility with a pasty feeling of the organ.

With a diagnosis of perforated viscus the patient was operated upon under morphine scopolamine ether anesthesia. Considerable pus was encountered. The appendix was hyperemic and adherent to the cecum and distal loop (ileum). Appendectomy was performed. On the left side was noted a large pyosalpinx about the size of a small cucumber adherent to the sigmoid colon and with an anterior laceration

from which was exuding pus. The right adnexa presented slight tumefaction with no discharge of pus. The left adnexa were excised, the spillage aspirated and closure with a Mikulicz tube was performed but only partial closure was made of the layers of the abdominal wall. The patient was given glucose by hypodermoclysis, vitamin C, cardiotonics, and penicillin 20,000 units every 3 hours up to a total of 900,000 units. The condition gradually improved and drainage ceased by the eighteenth day.

The author believes that undoubtedly the trauma was responsible for the rupture. He thinks that this is a rare case for among the thousands of patients with abdominal contusion operated upon at the Pellegrini Hospital no similar lesion was previously reported.

A review of the literature is presented. Among the recommended treatments are simple drainage with a rubber drain or a Mikulicz tube, excision of the adnexa, unilateral or bilateral hysterectomy total or subtotal. The author believes that surgery should be limited to the cases in which it is indispensable that the cause of the peritonitis should be removed and abdominal drainage should follow. The more formidable procedures, such as hysterectomy, are not recommended in the presence of peritonitis even though the patient may be operated upon early and in good condition.

LOCLAN J. FRAMONTI, M.D.

Nodular Fallopian Tubes (Trompas nodulares)  
M. TELER PACHECO ULLAO. *Bol. Soc. chilena obst. ginec.*  
1947 7

The author has made a clinical and anatomopathologic study of 20 complete tubes and 4 tubal stumps surgically removed from 15 patients. The lesions were found in the isthmus portion of the tube in 66.6 per cent and in the interstitial portion in 33.3 per cent. Often the tube was diffusely enlarged and presented various nodules which could be seen and felt; they were round, hard smooth generally free (without adhesions to the neighboring structures) and had the same color as the rest of the tube. Their greatest diameter was 1.5 cm., but the usual diameter was 0.5 cm. They were bilateral in 53.3 per cent of the cases. The nodules were due to diverticulosis in 53.3 per cent of the specimens, to tuberculosis in 33.3 per cent, and to nonspecific chronic salpingitis in 13.3 per cent.

The characteristic morphology of diverticulosis of the tubes, also called "tubal adenomyosis," is the presence on the entire inside of the enlarged segment, of numerous diverticuli which are lined with glandular epithelium of tubal type (endosalpingiosis) or endometrial type (endometriosis). In the present series endosalpingiosis was present in 33.3 per cent and endometriosis in 30 per cent.

The collections of glandular epithelium form irregular alveolar spaces, uniformly distributed in the muscular layer from the mucosa to the serosa and separated only by a small amount of muscular tissue. The entire wall is changed into a veritable honeycomb of spaces. Often the lumen of the tube is much

decreased in the region of the diverticulosis and may be completely closed distal to it. The alveolar spaces vary in size and form; sometimes they are empty while at other times they contain a thick fluid, blood, desquamated epithelial cells or macrophages. In case of endosalpingiosis the secondary cavities do not have a stroma but are lined by tubal epithelium which lies directly on the musculature. In case of endometriosis there is an undifferentiated mesenchymatous tissue similar to the stroma of the endometrium inside of the musculature, which surrounds the alveolar spaces lined with typical endometrial glands having a high cylindrical epithelium with or without signs of secretory activity.

Whether the lesion is produced by inflammation or is of congenital origin is still under discussion. Of 8 patients with tubal diverticulosis, only 2 had previous pelvic inflammation and none showed histologic traces of inflammatory infiltration. On the other hand, 3 patients presented congenital anomalies (hypoplasia of the genital apparatus, vaginal atresia and rudimentary double uterus and uterus bicornis) which supported the theory of congenital origin.

The symptomatology was masked in all cases by that of the other gynecologic disorders which led the patients to surgery; but in 75 per cent there was an intense and progressive premenstrual and menstrual dysmenorrhea accompanied by hypermenorrhea and a high incidence of prolonged periods of sterility.

Tuberculosis of the tubes was bilateral in all cases and there was primary sterility in 80 per cent. The ages of the patients ranged from 20 to 37 years. The fibrocystic or caseous nodules in the wall of the tube presented the typical rosette aspect. In most cases there was also a secondary endometrial tuberculosis.

Non specific chronic salpingitis was bilateral in all cases and histologic section showed strong inflammatory infiltration with small intraparietal abscesses, atrophied mucosa, and greatly reduced lumen. All of the patients were sterile.

Women in whom the problem of sterility must be taken into account should be given conservative surgery which in most cases will consist of tubal implantation into the uterus after resection of the involved portion even when the tube is permeable. Women in whom it is not necessary to consider this problem should be treated radically. Tuberculous tubes must be completely extirpated irrespective of the age of the patient; this is generally associated with subtotal hysterectomy. Tubes with nonspecific chronic infection should be removed with or without associated hysterectomy.

RICHARD KEMEL, M.D.

#### EXTERNAL GENITALIA

Prolapse of the Vaginal Vault following Hysterectomy: A New Method of Repair. HENRY N. SHAW. *West. J. Surg.* 1948, 56 7

An operation to correct prolapse of the vaginal vault by the use of fascial strips is described. A midline incision is made and the peritoneal cavity is opened. Fascial strips 1.5 cm. wide are dissected

from each side of the midline incision in the rectus fascia. A catgut suture is placed deep in the posterior surface of the vaginal vault or cervical stump after it has been isolated in the peritoneal cavity.

A curved Kelly clamp is passed between the rectus muscle and peritoneum to the internal inguinal ring. The clamp is now passed beneath the peritoneum following the course of the round ligament and down to the catgut suture. The clamp enters the peritoneal cavity at this point grasps the end of the suture previously introduced into the vault of the vagina and draws the suture out to the surface through the internal inguinal ring. The catgut suture is tied to the upper end of the fascial strip which is then drawn back into the peritoneal cavity along the tunnel created by the Kelly clamp. The fascial strip is now sutured to the posterior surface of the vaginal vault or cervical stump with 2 silk sutures. The procedure is repeated on the opposite side and the abdomen closed in layers.

Since 1923 the author has had 12 cases of prolapse of the vaginal vault following hysterectomy. Nine patients were treated by removal of the cervical stump when present, and extensive repair of an associated cystocele. Three patients were successfully treated by means of the operation described.

GEORGE BLIXICK, M D

#### The Treatment of Vaginitis with Penicillin Vaginal Suppositories. STUART ABEL and CHESTER J. FARMER. *Q Bull Northwest Univ M School* 1948, 22 5

Twenty patients suffering from various types of vaginitis were treated with cocoa butter suppositories containing 100,000 units of penicillin calcium. Smears and cultures were made prior to treatment. Seven of the group reacted positively for trichomonas vaginalis organisms in the rest of the cases the organisms were of a nonspecific type.

The results of treatment of the patients suffering with trichomonas vaginalis organisms were disappointing and would seem to indicate that the treatment had little value. Douches were not used. The other patients, in whom cultures showed a variety of organisms of a nonspecific nature, all showed complete or nearly complete improvement.

The average dose of penicillin used in the treatment of this group was 600,000 units and the average duration of treatment, 11 days. The authors suggest that penicillin in the form of suppositories might be of benefit in the preoperative preparation and postoperative care of patients in whom extensive vaginal operative work is planned.

GEORGE B. BRADSHAW, M.D.

#### Vaginal Repair Combined with Vaginal Hysterectomy. J. E. HARRISON. *Am J Obst* 1948, 55 403

Vaginal hysterectomy for repair of the vagina in varying degrees of prolapse presents distinct advantages over certain other methods of treatment of this affliction and yet this treatment is not commonly applied. Most of the literature on this sub-

ject to date lacks detail in description and passes over some of the important as well as some of the most difficult steps in the operation as if they did not exist. The author believes that this lack of detail may contribute to the fact that the operation is not performed more widely by gynecologists.

Removal of the uterus during the course of vaginal repair is indicated far more frequently than it is practiced. The operation presents distinct advantages in selected cases over any other form of treatment of procidentia and gynecologists in general should be encouraged to perform it.

The most important anatomical considerations are briefly outlined with reference for further detail to the recent publication *The Pelvic Floor in Parturition* by Richard Power of Montreal in *Surgery Gynecology and Obstetrics* September 1946.

The indications and contraindications for vaginal hysterectomy in the repair of procidentia are discussed and the advantages and disadvantages of the operation are considered.

A detailed technique of operation is described and illustrated.

JOHN R. WOLFE, M D

#### MISCELLANEOUS

#### Presacral Neurectomy for Dysmenorrhea. FRANCIS M. INGERSOLL and JOE V. MIZICK. *N England J M* 1948 238 357

During the past 16 years the authors have performed 111 presacral neurectomies for the relief of dysmenorrhea. The patients were divided into two groups: those with essential dysmenorrhea and those with acquired dysmenorrhea. Complete relief was obtained in 81 per cent and partial relief in 4.5 per cent of the patients with essential dysmenorrhea. 14.5 per cent of these failed to obtain relief. In the group with acquired dysmenorrhea, complete relief was obtained in 52.6 per cent and partial relief in 21 per cent. In 26.4 per cent of these the operation failed. The etiology of acquired dysmenorrhea in the order of frequency was (1) endometriosis, (2) postpartum dysmenorrhea, (3) pelvic inflammation and (4) post-appendectomy dysmenorrhea.

An analysis of the cases in which presacral neurectomy failed to produce relief of essential dysmenorrhea revealed three possible causes for the failure: (1) psychoneurosis, (2) regeneration of sympathetic nerves and (3) incomplete sympathectomy.

In an attempt to eliminate the psychoneurotic patient the authors have devised a test which consists of preventing ovulation by the use of estrogen and then stopping the estrogen and allowing the patient to have withdrawal bleeding. Estrogen withdrawal bleeding or anovulatory bleeding is painless in the normal healthy female. If this test is carried out and the bleeding is still associated with pain the authors believe that the pain may be psychic in origin and that presacral neurectomy is contraindicated.

The second possible cause of failure of this operation is regeneration of the sympathetic nerves. Re-



operation of patients in whom the first procedure failed demonstrated the regenerated nerve. The infrequency of regeneration following this type of sympathectomy may be due to the fact that such a long segment of nerve is removed that the widely separated nerve ends never rejoin.

The third possible cause of failure is an inadequate sympathectomy. The presacral nerve is a distinct nerve in only 25 per cent of the cases, therefore the anatomic variations may well account for some of the failures of this operation.

Twenty-four of the 31 patients have given birth to children since the presacral neurectomy was performed and labor was painless in 33 per cent of the patients.

Follow-up studies revealed that 7 patients with essential dysmenorrhea continued to have backache during menstruation and in labor. This is caused by the fact that all of the afferent fibers do not pass through the presacral plexus but pass transversely through the second, third, and fourth sacral segments and produce the referred backache.

The authors conclude that patients with essential dysmenorrhea obtain the best results and that patients with acquired dysmenorrhea have only a 50 per cent chance of obtaining relief from pain. The reasons for failure are discussed.

J. ROBERT WILLSON, M.D.

Clinical-Statistical Contribution to the Study of Tuberculosis of the Female Genitalia (Contributo clinico-statistico allo studio della tubercolosi genitale femminile). LUCI NO NOMBILI. *Riv. Ital. G.* 1947 3: 253.

Seventy women with genital tuberculosis were subjected to surgical therapy in the gynecological and obstetrical clinic of the University of Bologna, Italy during the period from 1936 to 1946. The author's material comprises 91 per cent of all gynecological admissions (7,653 cases) during this period. These patients were late in menstruating, 18.75 per cent did not menstruate until they were more than 6 years of age. Menstrual disorders were noted in 60 per cent of the patients, 40 per cent of these had amenorrhea or oligomenorrhea.

In the greater number of these patients (38.57 per cent) the condition occurred in the third decade of life. The material comprised 27 single and 43 married women. Of the married patients, 25 had never been pregnant, had suffered abortions, and 16 had borne children. The 16 fertile women had had an average of 17 children each.

In 59.37 per cent of the cases, a focus of tuberculosis was present and had been present in other organs of the body. This does not mean, however, that in all of the other patients the genital lesion was primary. There were probably other primary lesions elsewhere which were not found, or had healed. The author believes that the descending route, that is, the peritoneum being first involved primarily was the commonest form of dissemination. There were only 2 instances of involvement of the cervix, with

the complication of a tuberculous salpingitis in 1 of these. In 4 patients the body of the uterus was the part affected, 2 of these had an associated tuberculous salpingitis, and 2 had a fibrocystic peritonitis. The internal orifice of the cervical canal seemed to form an insuperable barrier to the spread of the process. In 54 (77.14 per cent) of the patients the tube was the part involved. In 7 (12.06 per cent) of these there was an associated exudative peritonitis, in 27 (50.00 per cent) a fibrocystic peritonitis, and in 20 (37.03 per cent) the salpingitis was an isolated phenomenon. Of 19 cases of proosalpinx, 14 were bilateral, 12 cases of nodular caseous salpingitis, 12 were bilateral. There were 4 patients with a simple tuberculous inflammatory salpingitis bilateral in 3. There were 2 cases of tubo-ovarian abscess. In addition, 13 instances of tubal infection were observed among those patients with uterine and ovarian involvement. There were 10 cases of tubercular involvement of the ovary (14.28 per cent) associated with a tuberculous salpingitis (in 3) and a fibrocystic peritonitis (in 7). In 7 cases the lesion in the ovary was monolateral in 3, bilateral. As regards the involvement of the peritoneum in these genital lesions, there were 37 instances (51.85%) of fibrocystic tuberculous peritonitis and 7 (10.00%) of peritoneal ascites.

In the surgical treatment of the more severe conditions, spinal anesthesia was preferred. Subtotal hysterectomy and bilateral adnexectomy were performed in 45 patients, and a total hysterectomy and bilateral adnexectomy in 2 patients. In only 4 instances were the tubes and ovaries removed in 2 patients both tubes and one ovary were removed. In 10 of these patients exploratory laparotomy revealed conditions contraindicating further surgical procedures. In 5 patients the abnormal contents of the abdominal cavity were evacuated without attempting removal of the involved organs themselves.

In the complete series 1 patient died on the day of operation. Of the rest, 37 patients could be traced for periods of from 4 to 10 years. Five others have died, however, only after at least 2 years of normal life, usually at their original occupations. Of the remaining 32 patients, 18 recovered from the operation and have since remained without symptoms (optimum result) in 12 patients the results were good that is, the mild ailments such as leucorrhea, castration phenomena, and vague pains were no worse than would be expected following any other type of gynecological operation. In 3, the results were mediocre and the patients complained of vague pains (ascribable to residual adhesions). There was 1 case of laparocoele, and 1 case of residual parietal fistula which developed following Mikulicz drain and required a year to heal.

These results show the high percentage of recoveries (86.12%). The author ascribes this exceptional achievement to the fact that at Bologna surgeons are neither interventionists nor abstentionists, but they adopt an eclectic attitude toward the individual patient and consider whether to operate and what

type of operation would give the best result. Nevertheless they have never subscribed to the seductive theory that removal of the gravest tuberculous lesion may result in improvement or disappearance of the residual lesions. They have always attempted to carry the operation to the point of removing all of the diseased tissue unless stopped by some insurmountable technical difficulty. The patients are kept under close clinical observation and every resource is exhausted to detect any other focus of infection in the body and to evaluate the general condition and readiness for operation of the patient. This period of repose coupled with high calory and high vitamin diet, may be cut short by some urgent indication to operate. It may last for a week or longer. In one patient the period of observation lasted for more than 8 months before operation was attempted.

JOHN W. BRENNAN M.D.

#### In Vitro Fertilization and Cleavage of Human Ovarian Eggs. MIRIAM F. MENKIN and JOHN ROCK. *Am J Obst* 1948 55 440.

Most textbooks of embryology comment on our lack of knowledge of the fertilization and first cleavage stages of the human ovum. In 1939 Pincus and Saunders reported that about 30 per cent of human ovarian ova cultured in blood serum for intervals ranging between 8½ and 24 hours showed polar body formation and hence became theoretically susceptible to fertilization. On the basis of these findings the authors have made numerous attempts to initiate in vitro fertilization of human ovarian eggs cultured for varying lengths of time from ovarian tissue removed just prior to the expected time of ovulation.

Several factors were varied throughout the period of the study e.g. the conditions of culture of the eggs both before and after exposure to spermatozoa, the duration of contact of egg and spermatozoa and the concentration of the sperm suspensions used. Employing a certain combination of these variables the authors were able to induce cleavage in three experiments. In 2 of these cases the egg was found to be in the two-cell stage. In the third case two eggs divided but one part of the cytoplasm appeared fragmented and soon proceeded to undergo rapid degenerative changes. In the present report discussion is confined to the two eggs in the two-cell stage and the more normal appearing of the two eggs in the three-cell stage.

The authors report in detail the procedures involved in obtaining their specimens and in the culture and fertilization of the specimens. A complete series of stained sections of one of the eggs in the two-cell stage was obtained and is described. The egg in the three-cell stage was similarly prepared.

A photomicrograph of the stained section of the follicle from which an egg was obtained is presented and described. This follicle represents a typical 'preovulatory stage' i.e., a mature follicle that is just about to rupture. It is the only section in existence as far as is known of a human ovarian

follicle which can be exactly dated with respect to subsequent fertilization of the egg derived from it.

The time relations in these experiments are in general accord with those reported previously for the in vivo fertilized tubal monkey egg cultured in vitro as well as for in vivo fertilized mouse eggs studied at different intervals after copulation.

JOHN R. WOLFF M.D.

#### Pelvic Sympathocytoma (Simpaticotoma pelviana) S. DEXEUS. *Rev espal. obst* 1947 4 395

This article reports the case of a 25 year old woman, a para iii, who suffered for 6 months with pain in the right iliac fossa. Bimanual pelvic examination showed the uterus to be in ante flexion and displaced to the left. Both adnexa were normal. In the right iliac fossa however, there was an easily outlined mass, of the size of a hen's egg. The tumor was solid and smooth and appeared to be attached to the sacrum.

At operation the tumor was mobilized with ease from its sacral bed despite a traversing right ureter. A short pedicle facilitated excision *in toto*.

Microscopically the tumor consisted of nerve cells mixed with connective and vascular tissue. The nerve cells were of the sympathetic ganglion type arranged in small clusters. The plexuses of the nerve fibers were very irregular. There was an abundance of pigmentation and the periphery of the tumor was composed of dense connective tissue.

The tumor was benign hence the prognosis was good particularly since removal was complete.

The author was able to find only 13 similar cases in the literature at his disposal.

STEPHEN A. ZIDMAN M.D.

#### Injuries to the Bladder in Gynecological Surgery J. K. FEEKEY. *Irish J Med Sc.* 1948 Series 6 113

Because of the normal intimate contact of the urinary bladder and the uterus and also the structural changes resulting from uterine and adnexal disease it is to be expected that bladder injuries will some times occur in the course of abdominal and vaginal gynecologic operations. The author considers various pitfalls and suggests ways of minimizing their occurrence.

#### BLADDER INJURY IN ABDOMINAL OPERATIONS

**Incision of the parietal peritoneum.** During this procedure one must avoid opening into a bladder distended with urine or misplaced because of adhesions or tumors. This is accomplished by incising the peritoneum in the upper limits of the abdominal wound and looking through the peritoneum from the inner surface, the lowest limit of translucency in indicating the upper limit of the bladder. Preoperative catheterization should be a routine measure.

**Downward displacement of the bladder in complete hysterectomy.** In the downward displacement of the bladder effected to afford safe access to the uterine arteries, the lateral cervical attachments and the vagina, various precautions are necessary.

1 The vesicouterine fold of peritoneum may be divided too close to its reflection from the bladder. To eliminate this possibility the bladder is identified by a ridge in the lower part of the vesicouterine pouch and sufficient peritoneum for later peritonization preserved.

2 When dividing the fascial fibers between the bladder and the lower uterine segment and cervix one should displace the bladder downwards with gauze or fingers and cautiously snip with the points of the scissors directed toward the uterus.

3 Downward displacement of the bladder should be so gentle as not to damage muscle or vascular supply since it is conceivable that a vesicovaginal fistula could result from later distention of a weakened area.

4 The bladder if not sufficiently displaced off the anterior vaginal wall may be included in the incision intended to open into the anterior fornix.

5 The bladder may be caught in the clamps applied to the lateral cervical attachments. To prevent this one should displace the bladder downwards and outwards at each side and apply the clamps only under direct vision and touch.

6 In placing the angle sutures and in peritonizing accidental inclusion of a tiny piece of bladder wall is possible. Here again good vision is important.

*Abdominal operations other than total hysterectomy.* In hysterectomy or myomectomy for fibroids or chronic inflammatory disease the usual bladder relations may be disturbed. Care is necessary not only in preserving the bladder but the ureters also. In the course of a Wertheim hysterectomy both bladder and ureters must be constantly safeguarded especially in the area adjacent to the trigone. In extra-peritoneal fascial strap operations for stress incontinence the bladder neck is identified by its proxim-

ity to the expanded end of a rubber malecot catheter. The author knows of 2 cases of incarceration of the distended bladder following intraperitoneal round ligament suspension. Both patients required celiotomy for relief. Such a method of uterine suspension is therefore not recommended.

#### INJURY TO THE BLADDER IN VAGINAL OPERATIONS

Various vaginal operations require elevation of the bladder along the supravaginal cervix and lower uterine segment.

In the Manchester operation for prolapse in which the lateral cervical ligaments are united anterior to the cervix, the bladder and ureters have occasionally been included in the approximating sutures.

In vaginal hysterectomy and in the interposition operation, in attempting to gain access to the vesicouterine fold of peritoneum the bladder lumen may be entered.

With Shaw's colporrhaphy difficulty may be encountered in suturing the cranial end of the post-urethral ligament on the front of the supravaginal cervix.

#### VESICO-VAGINAL FISTULA FOLLOWING TOTAL ABDOMINAL OR VAGINAL HYSTERECTOMY

The repair of such a fistula may be very difficult since the opening is in an almost inaccessible area without a cervix upon which to exert traction and facilitate exposure. The author believes it is important to wait 3 months before attempting repair to treat urinary infection with sulfonamide and ammonium chloride, and to use No. 000 plain catgut in the bladder and No. 0 chromic catgut in the vagina.

Clinical details of 9 cases of bladder injury following abdominal operations are presented.

W. REY R. LANG, M.D.

# OBSTETRICS

## PREGNANCY AND ITS COMPLICATIONS

Ectopic Pregnancy W D BEACHAM, CONRAD G COLLINS, E. PERRY THOMAS and DAN W BEACHAM. *J Am M Ass.*, 1948, 136 365

The authors analyze a series of 1,059 cases of ectopic pregnancy collected from the records of the New Orleans Charity Hospital from 1906 through 1946. The racial incidence was compared in relation to the number of deliveries and number of gynecologic admissions. A summary of the graphs presented tends to show a slightly higher percentage of colored gynecologic patients with ectopic pregnancy than white patients 0.9 and 0.7 per cent, respectively. Comparison made with obstetrical admissions gives a white incidence of 1.5 per cent against a colored of 0.9 per cent. The difference is explained on the higher over all incidence of colored obstetrical admissions while the white admissions were confined largely to a group who had complications.

Age incidence figures showed that the majority of ectopic pregnancies in colored women occurred between the ages of 21 and 30 while in white women it was between the ages of 25 and 36.

An analysis of the authors' last group of patients from 1937 to 1946 comprising 381 showed that only 66 or about 17 per cent had not been pregnant previously. Thirteen or 3.4 per cent, had undergone a previously proved ectopic pregnancy.

Among 750 cases the right tube was involved in 60.1 per cent and the left in 39.9 per cent. 13.8 per cent of the pregnancies were intact, 70.8 per cent ruptured, and 16.4 per cent were classed as tubal abortions. Bilateral tubal pregnancy was seen in 2 patients and a combined extrauterine and intra uterine pregnancy was noted in 4 patients.

In the group of 381 patients seen between 1937 and 1946 there were 69 who had had previous lower abdominal surgery most often appendectomy. Salpingitis was reported in 134 or 36 per cent. No case of tuberculosis of the tube was noted.

The chief complaint was pain in 67.8 per cent, pain and bleeding in 20.3 per cent, and bleeding alone in 8.9 per cent. There was an accurate correlation of the location of the pain with the location of the ectopic pregnancy in 79 per cent. Shoulder pain occurred in 15.3 per cent.

The period of amenorrhea varied from none in 1.7 per cent to 7 months in 0.57 per cent, with the greatest peaks at 2 months (18.5%) and 3 months (14.3%). Colpocentesis was employed as a diagnostic step in 74 instances during the last 10 year period with positive findings in 69. The 5 other instances, reported as negative, were found to have free blood in the abdominal cavity at laparotomy a little later.

The operative procedures varied from unilateral salpingectomy to total hysterectomy with salpingectomy. The authors point out that the patient's

condition at the time of surgery should govern the extent of the procedure but that when the general condition warrants the "operator would do well to perform any indicated operation."

The maximum postoperative fever was noted in the majority of cases during the first 3 days, most often on the first day and in general it did not exceed a temperature of 102. The uncorrected mortality rate for the last 10 years was 2.89 per cent.

GEORGE B. BRADBURN M.D.

Transverse Presentation (Sobre presentación de tronco) MORIS VÁSQUEZ ZÓRIGA. *Bol Soc chilena obst gín* 1947 12 236.

The author analyzes 158 cases of transverse presentation encountered among 39,038 admissions to the Angel C Sanhueza Maternity, Santiago de Chile from April, 1941 to December 1946. The ages of the patients ranged from 15 to 48 years but 94 (59.4 per cent) were between 21 and 30 years of age. There were 139 multiparas (87.9 per cent) and 19 primiparas (12.1 per cent). The statistics of the various obstetrical services of the Capital seem to indicate that the number of transverse presentations has been decreasing in the last 10 years.

Among the maternal causes of transverse presentation multiparity was outstanding while bony pelvis dystocia and uterine malformation (uterus bicornis) were found in one case each.

Among the fetal causes, prematurity accounted for 48.7 per cent of the cases, macerated fetus for 10.6 per cent, and twin pregnancy for 15.1 per cent.

Among the ovular causes, placenta previa was found in 6.3 per cent of the cases and hydramnios in 4.4 per cent.

Rupture of the membranes in the presence of a living fetus was spontaneous and premature in 12 cases with a fetal mortality of 5 (41.6 per cent) spontaneous and inopportune early in 26 cases with a fetal mortality of 6 (23.07 per cent) and spontaneous and timely in 20 with a fetal mortality of 5 (25 per cent). Rupture was artificial with complete dilatation in 29 cases, resulting in a fetal mortality of 4 (13.7 per cent) and with incomplete dilatation in 18 cases resulting in a fetal mortality of 3 (16.6 per cent).

Prolapse of an upper extremity was observed in 40 cases (25 per cent). In 3 of these there was edema and brachial paralysis of the prolapsed member which had regressed about 50 per cent at the time of discharge.

Prolapse of the cord occurred on 25 cases (15.6 per cent). Potential prolapse (procubitus) was observed in 3 cases. The fetal mortality for prolapse of the cord was 38 per cent.

Internal version was performed in 144 cases (90 per cent), in 21 of which the fetus was dead and in 123 the fetus was living. Preliminary manual dilata-

tation of the cervix was necessary in 43 cases, and vulvovaginal dilatation was performed in 14 primiparas. Complications observed during or immediately after internal version included 12 perineal, 3 vaginal, and 11 cervical lacerations; elevation of the arms occurred in 21 cases; retention of the following head in 18; acute anemia in 3; obstetrical shock in 5; and rupture of the uterus in 3 (2.08 per cent). Simple puerperal endometritis was observed in 14 cases, grave puerperal sepsis in 3, and phlegmon of the right large ligament and infection of a vaginoperineal laceration in one each. Delivery by the natural route resulted in 27 fetal deaths (21.9 per cent) and 4 maternal deaths (3.75 per cent).

Segmental cesarean section was performed on 8 patients, in 6 of whom the fetus was living and in 2 dead. Laparotomy was performed on 2 patients to extract a dead fetus which was arrested and partly out of the uterus.

Transverse presentation has a bad prognosis for the fetus (19. per cent) fetuses being dead on admission. Delivery by the natural route resulted in a fetal mortality of 50 per cent in primiparas and 30 per cent in multiparas. There was no fetal mortality in extraction by the high route.

There are two prophylactic measures to be taken against the occurrence of transverse presentation: (1) strict control of the personnel of the domiciliary obstetrical services (any incompetent or negligent individual should be eliminated) and (2) any patient in whom a transverse presentation has been observed at 8 months or over should be hospitalized for labor even when the results of external version are satisfactory.

RICHARD KEMEL, M.D.

## PUERPERUM AND ITS COMPLICATIONS

The Diagnosis, Prevention, and Treatment of Puerperal Infection. ARTHUR M. HILL and HILDA M. BUTLER. *Med J Australia*, 948, 27

The authors report their experience with puerperal sepsis at the Women's Hospital in Melbourne and also attempt to correlate the bacteriologic and clinical findings in 1,341 cases.

The bacteria associated with puerperal infections can be divided into three groups:

1. Anaerobic streptococci: the *Streptococcus hemolyticus* group A and the *Staphylococcus pyogenes*.
2. Hemolytic streptococci of groups other than A: *Bacterium coli*, nonsporulating anaerobic bacilli, aerobic nonhemolytic streptococci, diphtheroids, and the *Clostridium welchii*.
3. The *Neisseria gonorrhoeae* and the *Streptococcus pneumoniae*.

The first group is by far the most important both from the standpoint of frequency of occurrence and severity of infections produced. In this series anaerobic streptococci were held primarily responsible for 80 per cent of the infections, although other bacteria were often present as well. Thirty of 33 patients with puerperal septicemia had blood cultures which were positive for the same organism.

Bacteria of the second group are less common and less virulent. Infections from bacteria of the third group are very rare.

On the basis of source, the bacteria responsible for puerperal sepsis fall into three categories: those from without (mainly the *Streptococcus haemolyticus* group A and the *Staphylococcus pyogenes*) those which are normally inhabitants of the vagina (hemolytic streptococci of groups other than A, anaerobic streptococci, anaerobic gram-negative bacilli, diphtheroids, and aerobic nonhemolytic streptococci) and those which come from viscera adjacent to the bladder (anaerobic streptococci from the urethra and the *Bacterium coli* and *Clostridium welchii* from the rectum).

Puerperal infections are also divisible into the infectious and the non-infectious on the basis of the ability of the causative bacteria to spread from case to case. The *Streptococcus hemolyticus* group A is transmitted by dust and droplet, while the *Staphylococcus pyogenes* infections are usually transmitted by contact. Mechanical introduction is most common with the fecal bacteria (*Bacterium coli* and *Clostridium welchii*). The anaerobic infections are not infectious.

The severity of the disease depends on the virulence of the strain, the degree of maternal resistance, and the associated bacteria. Anatomically puerperal infection occurs in the following grades of severity: (1) infection localized to the birth canal—this is both the mildest and commonest form, the most frequent manifestation being acute endometritis; (2) infection spreading beyond the birth canal but localized to the pelvis—this is exemplified by pelvic peritonitis, pelvic cellulitis, and pelvic thrombophlebitis; (3) general peritonitis; and (4) septicemia. The latter two are grave varieties of sepsis. On the whole, however, the authors find only slight correlation between the clinical picture and the etiological bacteriological agent.

Whenever the course of the puerperium is complicated by (1) a temperature of 100° F or higher, (2) a temperature of 100° F or more for 24 hours, (3) jaundice, (4) unexplained tachycardia, or (5) an offensive or purulent discharge, a careful history and a complete physical examination are in order. Vaginal and urinary cultures and in some instances blood cultures, should be taken.

Preventive measures in puerperal infection are of two types—those employed by the community and those applied in the individual case by the obstetrician and others in attendance. Communal measures include efficient prenatal clinics and lying-in units available to all patients. The obstetrician on the other hand, must bring his patient to the best possible state of health, and conduct the labor and puerperium with a minimum of interference and a maximum of aseptic technique. Prophylactic chemotherapy and isolation are essential at times.

Good nursing care is the keynote of treatment. Adjuncts are a liberal diet, maintenance of fluid balance, Fowler's position, bland aperients, ferrous

iron and blood transfusions. Chemotherapeutic agents and antibiotics are almost routine. Surgical measures must at times be employed.

Although puerperal infection is not so severe or frequent today as 15 years ago, the precise application of modern knowledge and methods of control should relegate this condition to a minor role in the production of maternal morbidity and mortality.

WARREN R. LANG, M.D.

**Penicillin and Sulfonamide Therapy in Puerperal Infections** (Penicilioterapia y sulfamidoterapia en infecciones puerperales) HERNÁN MORA LORCA and ORLANDO TRIVELLI ROCCH. *Bol. Soc. chilena obst. gín.*, 1947 12 189.

A study of the files of the Angel C. Sanhueza Maternity, Santiago de Chile for the 4 year period from 1943 to 1946 shows that 742 cases of puerperal infection were treated with sulfonamides and 206 with penicillin. The mortality in the sulfonamide treated cases was 0.94 per cent for puerperal infections in general, 50 per cent for puerperal sepsis and 0.86 per cent for pelvic processes. The mortality in penicillin treated cases was 5.82 per cent for puerperal infections in general, 38.46 per cent for puerperal sepsis and 1.66 per cent for pelvic processes.

The average number of days required for the acute symptoms to become chronic (effectivity time) in the sulfonamide and the penicillin treated cases respectively was 7.15 and 10.33 for puerperal infections in general, 6.25 and 3.6 for putrid endometritis, 6 and 5.33 for endometritis in general, 4.8 and 4.7 for simple endometritis, and 7.99 and 9.6 for purulent endometritis.

Consequently the mortality is lower with penicillin therapy in puerperal sepsis, but this result is not significant statistically. The mortality is lower with sulfonamide therapy in puerperal infections in general and in pelvic processes, but the result is significant only in the first group. As to the effectivity time, penicillin has a better average in endometritis in general, simple endometritis, and putrid endometritis, but the result is significant only in the last group. The sulfonamides have a lower average of effectivity time in puerperal infections in general and in purulent endometritis, but the result is significant only in the first group. Penicillin therapy with associated treatment shows only one-third of the mortality of penicillin therapy alone, but this result is not significant.

The reason why penicillin has been less efficacious could lie in (a) the presence of penicillin resistant germs, (b) exaggerated confidence in its action, with disregard of other treatments, and (c) in many cases lack of exact knowledge concerning the use of penicillin. In addition the power of the drug may vary in connection with many factors such as transportation, changes of climate, and packaging. If the lower action of penicillin in many cases is due to the presence of penicillin resistant germs, the indication would be to make an early and careful bacteriologic investigation in every puerperal infection to serve as

a guide in the choice of the drug to be used. With this precaution a decrease or a reversal in the percentages should be obtained in a few years. When there is no chance to identify the causal germs it would be advisable to institute a combined treatment with penicillin and sulfonamides. Together with the antibiotics other therapeutic measures should not be delayed or ignored.

RICHARD KEMEL, M.D.

**Meningitis and the Puerperal State; Tuberculous Meningitis** (Meningitis e stato puerperale: la meningite tubercolare) GIOVANNI LUCCHETTI. *Riv. ostet. gín.* 1947 2 164.

The author reports 3 personal cases of tuberculous meningitis associated with pregnancy which he encountered in the past decade and reviews the 46 cases which he found in the literature.

The primary localization of the tuberculous infection which must necessarily exist in any case of tuberculous meningitis was clinically silent in over 50 per cent of the cases. The meningitis occurred predominantly in young women during their first pregnancy and appeared in the third trimester of the pregnancy in more than half of them. Lucchetti's patients were 26, 22 and 23 years old, respectively. In 25 per cent of the cases the meningitis appeared suddenly in the immediate postpartum period and this suggests that labor is a revealing or aggravating factor of the morbid process. The reason for the predilection of the meningitis to appear during these two periods is supposed to lie in the so-called anergy of pregnancy and the presumed massive introduction into the circulation of tubercle bacilli expressed from the site of placental insertion (tuberculous placentitis).

Pregnancy may lend a particular aspect to tuberculous meningitis, especially by exaggeration of some symptoms such as vomiting and convulsions. As a result diagnostic errors are frequent, especially with grave vomiting in the first half and eclampsia in the second half of pregnancy. Even the cerebrospinal fluid presents unusual characteristics, probably because the changes due to the meningeal infection interfere with those due to pregnancy.

For the differential diagnosis it is useful always to keep in mind the possibility of this rare entity and never to omit exact evaluation of all the clinical and diagnostic elements in doubtful cases, especially the anamnesis, the urine, spinal fluid and ocular fundus examinations, the arterial pressure, the time of appearance of disturbances common to pregnancy which differs from that in the ordinary case such as vomiting in the second half and convulsions in the first half.

Tuberculous meningitis rarely causes untimely interruption of pregnancy (12 per cent of the cases). Usually the patient dies during pregnancy if there is no intervention. Spontaneous as well as induced labor proceeds slowly because of marked uterine hypokinesia.

Pregnancy rarely modifies the course of the meningitis, but labor has a deleterious action on the dis-

case provoking it or aggravating its symptoms or rapidly leading the patient to death. In tuberculous meningitis, much more than in other tuberculous localizations during pregnancy the fetus is seriously compromised, probably through the mechanism of transplacental infection. Over 50 per cent of the fetuses in spontaneous or artificially induced labor die in the uterus or at the beginning of extrauterine life.

The treatment must consider especially the interests of the child. If the fetus is living intervention is indicated as soon as the diagnosis is made. If delivery can be obtained easily by the natural route, premature labor is induced otherwise, cesarean section is performed. Induced premature labor may eventually be accelerated, but this exposes the fetus to grave dangers because it is already weak. For cesarean section the most rapid type should be selected.

RICARDO KEMEL, M.D.

### NEWBORN

**Some Causes of Death of Stillborn and Newborn Infants Based on Postmortem Findings** (*Alcune cause di natimortalità sulla base dei reperti uteroidei*) CONRADO BELVEDERE. *Riv. Ital. ginec.*, 1947, 30, 109.

Of 10,737 newborn infants delivered in the Obstetrical Clinic of Bologna during the period from 1935 to 1944, 993 (5.05%) died or were born dead.

The dead infants may be divided into 3 groups: (1) those who died before labor prematurely or at the termination of pregnancy; (2) those who died during the delivery; and (3) those who lost their lives during the first 7 days after the delivery.

The author tabulated 127 stillbirths and deaths of newborn not according to the topography of the fatal lesion but in correlation with the etiology and clinical findings.

In the first group of 46 cases, the fetal death was attributable to intrauterine asphyxia provoked by a variety of factors. In the great majority of cases punctiform cerebral or meningeal hemorrhages were found.

In the second group of 22 premature deaths, the fatality was caused by a congenital debility without evidence of definite organic alterations.

In a group of 17 cases, acute pulmonary conditions, chiefly bronchopneumonitis, were responsible for death.

In 10 instances congenital fetal cardiopathies, chiefly a patent foramen ovale or a persistent ductus Botalli, were present.

In 12 cases endocranial hemorrhages of apparently nontraumatic origin and in 4 cases similar hemorrhages of traumatic origin were considered to be the cause of death.

A group of 16 cases the anatomopathologic findings did not fit into a single picture.

In the first mentioned group of 46 cases had podalic presentations. In 3 infants, centric previa, and in 2 premature detached

normally inserted placenta was found to be responsible for the asphyxia of the fetus. In 2 cases, a spontaneous prolapse of the umbilical cord, and in 3 a prolapse following the application of forceps, was recorded.

The last group consisted of a variety of conditions, such as congenital malformations of the urinary apparatus incompatible with life, e.g., aplasia of the kidneys, obliteration of the ureters, and hypertrophy of the thymus gland with compression of the superior vena cava.

ARTHUR F. CITELLI, M.D.

### MISCELLANEOUS

**The Permeability of the Human Placenta to Sodium in Normal and Abnormal Pregnancies and the Supply of Sodium to the Human Fetus as Determined with Radioactive Sodium.** L. B. FLECHNER, D. B. COWIE, L. M. HELLMAN, W. S. WILDE, and G. J. VOEGTLE. *Am. J. Obst.* 1948, 55, 469.

The present article is concerned primarily with the following problems: (1) measurement of the permeability of the normal human placenta to sodium from early in gestation to term; (2) comparison of the permeability of the human placenta with that of other placentas of the hemochorial group; (3) measurement of the effects of disease on placental permeability; and (4) evaluation of the supply of sodium to the fetus as this is related to the requirement for sodium during fetal growth.

The rationale and methods used to measure sodium transfer in terms of a radioactive isotope are presented in detail.

The human placenta, as is true for all the placental types which have been studied with the tracer technique, undergoes a very considerable increase in permeability to sodium as gestation proceeds. The peak in transfer rate per unit weight of placenta occurs at about the thirty-sixth week when it is approximately 70 times as great as at the ninth week, the earliest in the authors' series, and is followed by a rapid decline in permeability to term. These changes can be correlated with morphological changes which occur in the placenta during the process of aging.

fore reliable conclusions about placental function can be drawn.

The use of tracer substances permits the study of that aspect of fetal nutrition which is concerned with the quality of substances supplied to the fetus as this is related to the growth requirements of the fetus. The fetus receives across the placenta at the twelfth week of pregnancy 160 times as much sodium and at the fortieth week 1100 times as much as is incorporated in the growing tissues. This is the single exception which has been found to the hypothesis that the fundamental principle underlying placental function is that the rate at which substances are transferred to a unit weight of fetus shall parallel the relative growth rate of the fetus.

JOHN R. WOLFF M D

**Report of a Survey of Children Born in 1941 with Reference to Congenital Abnormalities Arising from Maternal Rubella.** P. R. PATRICK. *Med J Australia* 1948 1 431

The author reports the results of a survey of children born in 1941 in Queensland, Australia, with reference to congenital abnormalities arising from maternal rubella. A questionnaire was sent to 9 674 women who gave birth to infants in 1941. Of these 7,822 were returned completed. The following questions were asked in the letter sent to these women:

- 1 Did you suffer from German measles in 1940?
- 2 If so were you pregnant at the date of the attack of German measles?
- 3 If you were pregnant how many months were you pregnant at the date of the attack?
- 4 Has your child shown any physical defects especially those mentioned in the beginning of my letter?

A description of the symptoms of German measles was included in the letter as follows: "Pale pink rash clustered in small groups first on the face and neck and extending to the trunk and the limbs. On the second day the face is completely covered by rash. Sometimes there is no fever at all. There is a tender swelling of the glands behind the ear and back of the neck. They may reach the size of small peas. The glands in the armpit and groin frequently enlarged."

There were 262 cases in which mothers were certain they had rubella during that particular pregnancy. Of these 134 were in the Brisbane area, and 129 were examined clinically. These cases are tabulated and form the basis for the present report.

Of the 129 children examined 51 had some abnormality. Of these 37 had a serious defect. These included deaf mutism, mental deficiency, congenital cardiac disease, and cataracts. Thirty-seven patients had hearing defects, the vast majority (27) being grade 3 deafness (deaf mutism).

Of 40 children born in 1941 and (at the time of survey) attending the School for the Deaf and Blind 26 gave a history of maternal rubella.

Evidence was also gathered which showed that some mothers suffered miscarriages and some had

had stillborn infants after having suffered from rubella in pregnancy. The rubella may or may not have been the cause.

In Brisbane 28 children (of 77 cases) whose mothers had rubella in the first 4 months of pregnancy had serious abnormalities and 11 more had minor abnormalities.

No relationship was noted between the period of pregnancy during which the mother had rubella, and the type of abnormality. The most frequent abnormality was deafness, then in order of frequency congenital heart disease, mental deficiency, and cataracts.

Examination of the teeth of the children with the history of maternal rubella revealed the following abnormalities that might have been influenced by the rubella: (1) congenital absence of isolated deciduous teeth, (2) hypoplasia, and (3) retardation in tooth eruption.

The author makes the following suggestions: (1) rubella might be added to the list of notifiable diseases, (2) deliberate exposure of all girls to the disease might be practiced, (3) inoculation with rubella might be developed, suitable techniques are not yet available, (4) exposed pregnant women might be treated with immune globulin, (5) pregnancy might be terminated if rubella had been contracted in the first 4 months—a certain method but its justification is debatable, and (6) warn pregnant women not to expose themselves to the disease.

HARRY FIELD, M D

**A Study of Maternal Deaths in the Philippine General Hospital.** ALFREDO BAER. *J Philippine M A* 1948, 24 75.

From April 1, 1945 to July 31, 1947 there were admitted to the maternity service of the Philippine General Hospital 6,676 patients; the results were 4 611 live births and 212 stillbirths. There were 70 maternal deaths. Based on the total number of pregnancies the rate of mortality was 1.04 per cent. Based on the number of live births the ratio was 15.1 per 1,000 live births. At the Chicago Lying In Hospital the maternal death rate based on the number of pregnancies was 0.17 per cent for the period from 1931 to 1945. At The New York Lying In Hospital the figure for 11 years based also on the number of pregnancies was 0.19 per cent (uncorrected).

Of the 70 maternal deaths 34 (48.57%) were due to hemorrhage, and 22 (31.43%) were due to toxemia of pregnancy. In the hemorrhage group 11 (15.71%) were due to rupture of the uterus and in the toxemia group 18 (25.71%) were due to eclampsia. These were the major causes of 56 of the 70 maternal deaths. The causes of the remaining deaths are listed as follows: placenta previa (5), postpartum hemorrhage (5), hydatidiform mole (4), retention of placenta, manual extraction and shock (3), tubal pregnancy, salpingectomy and peritonitis (2), ablatio placenta (2), rupture of abdominal aneurysm (1), acute anemia after symphysectomy (1), acute



yellow atrophy of the liver (1) nephritis and pregnancy (3) puerperal infection peritonitis or both (1) pyelonephritis 1 case with acute transverse myelitis (3) bronchopneumonia (2) obstetrical shock (3) impending rupture of the uterus—Porro section, and shock (1) intra-abdominal pregnancy—partial hysterectomy (1) cardiac failure—valvular disease (1) intestinal obstruction (1) and military tuberculosis, sepsis, and miscarriage (1)

A very interesting observation concerning the list of causes is the very low incidence of infection as a cause of death, especially puerperal infection. At the Chicago Lying In Hospital from 1931 to 1945 infection accounted for 39.50 per cent of the deaths and at New York Lying In Hospital from 1933 to 1945 infection accounted for 22.80 per cent of the maternal deaths.

In this report hemorrhages claim the heaviest toll. Of the various hemorrhages rupture of the uterus was the most common cause. Two cases of rupture were due to the injudicious use of pituitrin one of the patients had 3 consecutive injections of  $\frac{1}{2}$  c.c. each. Two ruptures were associated with cranio-

tomies. One of the fetuses was a double headed monster.

Only one patient in this whole series was given the benefit of blood transfusion. Up to this date the Philippine General Hospital has not acquired the proper facilities for blood transfusion. Five cases of death accompanied placenta previa. In all of these there were no available donors. Five cases of death were due to severe postpartum hemorrhage. Four patients had been admitted in extremis.

The general impression given by these figures is that most of these deaths are preventable. However, a long range program of education of the laity, the training of more specialists in obstetrics and the establishment of more maternity services to meet modern requirements would be required.

The figure for mortality from rupture of the uterus alone (15.71%) indicates that patients are getting poor and inadequate prenatal care. The high incidence of eclampsia also bears this out. The greatest need for more adequate patient care in the hospital seems to be better transfusion facilities.

HARRY FIELDS, M.D.

# GENITOURINARY SURGERY

## ADRENAL, KIDNEY AND URETER

**Two Cases of Disease of the Vascular System Treated by Bilateral Suprarenal Medullectomy**  
DAVID H. BYGGLID *Acta chir scand* 1948 96 317

Bygglid reports the cases of 2 patients with peripheral vasoconstrictive disease in which sympathetic ganglionectomy did not sufficiently relieve the symptoms and in whom bilateral suprarenal medullectomy produced favorable results.

The first patient was a 58 year old male who had lost substantial parts of his fingers and toes because of peripheral vascular disease and in whom partial improvement had resulted from resection of the second third and fourth lumbar sympathetic trunk ganglia and the stellate ganglia. The left leg was amputated after a recurrence and bilateral suprarenal medullectomy was then performed. All pain edema, and loss of substance stopped.

The second patient was an 18 year old woman with cyanosis, edema, and trophic changes in both lower extremities. Bilateral lumbar ganglionectomy was performed. Two years later because of recurrence in the hands as well as in the knees bilateral medullectomy was performed in two stages. An excellent cure was obtained. The author exposed the suprarenal gland with an oblique incision under the twelfth rib. The latter is mobilized by resecting 1 cm. of the bone close to the transverse process. The adrenal gland is exposed and incised, and the medulla is curetted until the gland is transformed into a cavity.

The author has not however had sufficient experience with this operation in arterial hypertension to draw any conclusions. DAVID ROSENBLUM, M.D.

**A Case of Suprarenal Pheochromocytoma Clinically Diagnosed and Cured by Operation** NILS ALWALL and H. B. WULF *Acta chir scand.*, 1948, 96 337

Alwall and Wulf report a case of a 43 year old man who was observed for 4 years because of attacks of vomiting heartburn pallor palpitation trembling fatigue sweating and headache. These attacks lasted from 3 to 10 minutes and occurred as frequently as five times a day.

Plain abdominal films demonstrated a rounded well-defined shadow above the right kidney. The blood pressure was normal on repeated examinations. A diabetic type of sugar tolerance was shown by tests. Pressure on the site of the tumor hyperventilation and exercise did not produce an attack or hypertension.

The tumor was removed through a right renal incision. The operation was uneventful and recovery was normal. The pathologist reported the tumor as a pheochromocytoma.

The authors urge that pnelography planography perirenal insufflation and biochemical studies should

be employed in the diagnosis of suprarenal pheochromocytomas DAVID ROSENBLUM, M.D.

**Metastasizing Hypernephroma and Adenoma of the Adrenal Gland** JOHN A. TAYLOR. *J Urol.*, Balt. 1948 59 557

The author reported an interesting case of association of bilateral massive adrenal adenoma and hypernephroma (clear-celled carcinoma) of the right kidney with extensive metastases. Less than 70 such cases have been recorded in the literature. In practically all cases including the one under discussion these tumors were encountered at autopsy.

ROBERT TURELL, M.D.

**Radiologic Diagnosis. Perirenal Artificial Emphysema. Original Technique (Diagnóstico radiológico El neumorrón. Técnica original)** M. RUIZ RIVAS. *Arch. españ. urol* 1948 4 125.

The author now modifies the technique for inducing artificial oxygen gas emphysema about the kidneys and other organs of the posterior abdominal wall which he originally published in the *Revista Clínica Española* (May 15 1947).

With the present technique the spinal puncture needle is introduced into the presacral space at the level of the sacrococcygeal joint, about 1 cm. from the midline on either side. Preferably the patient maintains the genupectoral decubitus position the needle being passed inward toward the midline, upward toward the head and somewhat anteriorly in order to reach the presacral retroperitoneal tissues close to the anterior surface of the sacrum and in the midline. After the usual precautions for such injections have been taken the amount of oxygen estimated to be sufficient is introduced into the presacral fatty tissues and guided to the parts of the retroperitoneal tissues to be examined by manipulation of the patient's body posture perhaps the entire process being controlled at intervals by the fluoroscope.

The advantages claimed by the author for the present method over the preceding one are the avoiding of the menace of air embolism (by the present method the most highly vascular tissue traversed is the skin) and more even diffusion of the gas so that even in the presence of transposed or atopic organs the examination is not hindered. As a further advantage of the method might be mentioned the tendency of the injected gas to remain below the level of the diaphragm. Not only does one obtain excellent images of the kidney and the psoas muscle by this method but also of the suprarenals spleen liver the slips of insertion of the diaphragm and at times also of the gall bladder the thickness of the abdominal walls and of many other details which cannot be identified at the present time such as nerve ganglia, groups of lymphatic glands and neurovascular bundles.

The technique is simple and rapid and as a rule, will succeed at the first try.

JOHN W. BRIDGMAN, M.D.

**Bismjol** is a Contrast Medium for Ascending Pyelography (L'uso del bismjol come mezzo di contrasto nella pielografia ascendente) PAOLO ZONOLI and EDUARDO REGGIANTI. *Boll. Soc. med. chir. Modena*, 1947 47 77

Sodium bromide occasionally forms a small bolus in the ureters or the renal pelvis which may predispose to the formation of a calculus. Furthermore, the substance cannot be sterilized by heat without losing some of its opacity. Sodium iodide may have an irritating effect on the vesical mucosa or that of the renal pelvis. Lipiodol has no irritating effect and produces good shadows, but because of its great viscosity it is eliminated very slowly.

Because of such disadvantages of the opaque media used for ascending pyelography the authors attempted to replace them by a new compound called 'bismjol'. The composition of this new radiopaque substance is as follows: sodium iodobismuthite (0.15 gm.), sodium iodide (0.24 gm.) and ethylene glycol (20 c.c.). The compound was employed in 23 patients and it proved to produce good shadows. The substance is not toxic and has none of the aforementioned drawbacks of the customary radiopaque media.

Apparently there are no contraindications to the use of bismjol, except the conditions in which pyelography as such is not advisable, e.g. tuberculosis, and grave heart disease. Nausea, chills, vomiting or any other toxic symptoms have not been observed following its use.

Bismjol not only is aseptic but it displays also an antiseptic effect, and therefore the number of white blood corpuscles in the urinary sediment is usually diminished after pyelography. The substance has a low viscosity and is therefore easily eliminated with the urine. No irritating effect on the mucosa of the ureters or the renal pelvis has been observed. On the average, from 5 to 7 c.c. of the solution are introduced on each side and the injection is stopped immediately when the patient begins complaining of pain. When the examination is finished, a small amount of normal saline solution is injected through each catheter.

JOSEPH K. NARAT, M.D.

**Surgical Treatment of Nephritis.** MANUEL E. PASQUERA and EDUARDO HERNANDEZ L. *J. Urol. Balt.*, 1948, 59: 484.

The nephritis concept was vague and indefinite in former times and it remains so in our day in spite of the excellent descriptions of highly qualified researchers.

It is actually known that one of the most important causes of renal insufficiency in glomerulonephritis is renal ischemia, which is produced by the obstruction of small arterioles mainly in the glomeruli. The adequacy of any treatment is to build up an increase of intrarenal blood flow which thus far has never

been accomplished by any medication, probably because of the autonomous character of the renal circulation.

Recent studies of Homer Smith show that a new formation of vessels which supply the tubuli can be seen in diseased kidneys. Therefore, even if the glomerular filtration is not improved an advance in the process of secretion and reabsorption takes place in the tubules forming an important part of the total renal function. We can thus believe that an organic reaction takes place which relieves renal ischemia by the development of new vessels. Hence the use of any procedure which favors this reaction is completely justifiable.

This new vascularization has been frequently demonstrated in operative kidneys, microscopic slides or by color injections of the aorta with ligation of the renal arteries. Godard, Claude and Balazard, and Gentil and others, including the authors, have been able to prove this. They think that these facts justify the surgical treatment of nephritis.

The authors do not advise that surgical treatment be carried out in all early cases of nephritis but believe that it should be used whenever obvious failure of the usual medical treatment is observed without waiting until the lesions become nonregressive.

Before the surgical treatment is undertaken the following routine should be carried out: (1) investigation and treatment of all infectious foci in the teeth, tonsils, appendix, and prostate (there usually is more than one focus to be found, and in this country the highest percentage was found in the group of dental foci); (2) correct diet and sufficient vitamin supply (especially vitamin C); (3) complete rest; and (4) sulfa drug or penicillin treatments as indicated.

If in spite of this routine and close supervision over a certain time, we find a persistence of the symptoms or if the outlook is more serious, surgery should be considered. The cases are classified according to the following features, which are the indications and contraindications for surgical treatment: (1) cases with clinical evolution of from 4 months to 1 year; (2) with blood pressure not higher than 180 mm. (3) with no lesions of the retina; (4) with blood urea not higher than 60 mgm. per 100 c.c. of blood; (5) with blood creatinine not higher than 4 mgm. per 100 c.c. of blood; (6) with an Ehrlich xantoproteic reaction of less than 60 units; (7) with phenolsulfo-phthalein excretion of more than 35 per cent in 2 hours; and (8) with a urinary specific gravity higher than 1.015 after a dry diet given during 18 hours.

There is a common acceptance of the idea that the circulation of the kidney is completely autonomous and that the section or destruction of the renal nerves does not modify it in any way. However one must consider the association between the small arterial vessels of the kidney and the nervous system a fact that can be verified by the study of emotional reactions and arteriospasm. We also know that epinephrin produces enlargement of the kidney because of a spasmodic condition of the efferent vessel of the glomerulus. In view of the possibility

of avoiding the vasoconstriction produced by epinephrin the authors combined the nephromotomy with denervation according to Papin's technique. On the basis of these statements the authors have carried out the following technique in all of their cases:

1. Pfäumer's incision with resection of the last rib. In this way there is a wide operative field and trauma to the kidney which would be caused by a long operation carried out under other conditions is avoided.

2. Denervation according to Papin's technique.

3. Opening of the peritoneum and withdrawal of a portion of the omentum. This is fastened to the peritoneal opening by means of separate stitches in order to avoid retraction.

4. The omentum is placed between the renal tissue and the renal capsule by means of three incisions on the latter. One is made on the anterior face, the second is made on the external edge and the third on the posterior face following the procedure reported by Rittler.

5. Drainage and suture.

In order to gauge the results obtained by this treatment the clinical symptoms and the results of the laboratory tests must be considered. The first to consider is the presence of edema, lumbar pain, blood pressure, and microscopic hematuria. Later the following are closely watched: (1) urinary output, (2) urinary specific gravity, (3) albuminuria, (4) microscopic hematuria, (5) urinary casts, (6) blood urea, and (7) phenolsulfonphthalein excretion.

In order to have a more exact concept of hematuria and the existence of casts some of our cases were given the Addis count which was considered an important factor relating to this subject.

The authors are well satisfied with the results obtained from the operation. Most of the symptoms and the hematuria, casts, and albumin disappeared soon after the operation in many of their cases.

Of 11 patients who were operated upon 2 died. A study of these cases led in part to the establishment of the limits for the indications for surgery as neither of the 2 patients who died was within these limits. One of the two had severe hypertension with lesions of the retina; the other had advanced renal insufficiency.

JOHN A. LOEY, M.D.

**Diagnostic Considerations and Therapeutic Management of Renal Anthrax.** (Consideraciones diagnósticas y conducta terapéutica en el Antrax del riñón). ADOLFO FOXER. *An. ciruj. Rosario*, 1947 15: 196.

This article reports 5 cases of renal anthrax. The diagnosis was made on physical findings, and confirmed by x-ray and urologic studies. Two of the 5 patients were treated with 50,000 units of penicillin given intramuscularly every 3 hours and recovered without incident.

The 3 others had persistent elevation of temperature despite the fact that they received 100,000 units of penicillin every 3 hours. They were subjected to nephrectomy and recovered. The typical necrotic

areas with abscess formation were readily demonstrated in the operative specimens.

STEPHEN A. ZIEGLER, M.D.

**Solitary Cyst of the Kidney: Case Report.** R. ABBEY SMITH. *Brit. J. Urol.* 1948 30: 8.

The author discusses the literature on solitary cyst of the kidney and reports a case in a boy 18 years of age, with the following history:

Three years previously he had fallen 10 feet, following which he had severe sharp pain beneath the left ribs in the midaxillary line. After several days of bed rest the pain subsided completely. However on several subsequent occasions of physical strain he had recurrences. On one occasion he passed dark urine which he thought might have been blood.

Physical examination revealed a mass in the left hypocondrium and lumbar region. An intravenous and retrograde pyelogram showed obliteration of the upper and middle calices of the left kidney.

On operation a normal sized spleen was found to be pushed downward and forward by a large cyst continuous with the lower pole of the kidney. A left transperitoneal nephrectomy was performed.

The specimen measured 10 by 5 by 4 inches and weighed 3 lbs. 8 ozs. The large unilocular cyst of the lower pole contained 100 c.c. of clear yellow fluid.

JOHN A. LOEY, M.D.

**Prognosis in Polycystic Kidney Disease.** THOMAS R. MONTGOMERY. *J. Urol. Balt.* 1948 59: 477.

The lot of the patient with polycystic disease must have been improved materially with the introduction of the superior chemotherapeutic and antibiotic agents of this period. It is true that renal infection will develop in 50 per cent of these cases and that it will be severe in 30 per cent. This incidence of infection will undoubtedly continue but its control is much more certain. Therefore the need for surgical intervention of which drainage of renal and perirenal abscesses was most frequent should arise less often. Similarly with better control of infection stone formation, which heretofore has occurred in 50 per cent of these patients, might be reduced. Gross hematuria will probably continue to appear in from 30 to 40 per cent of these patients. Forty years of age should continue to be the average age at onset of the symptoms. Nor is there any known factor at present which is likely to reduce hypertension in these patients from its present high incidence of 60 per cent.

Surgery other than of the urinary tract in persons with polycystic kidneys is usually safely tolerated provided renal function is still practically normal. The enthusiasm for Rovsing's operation seems for the most part only lukewarm. It was followed too often by hemorrhage and infection. Penicillin, streptomycin and the sulfonamides may well increase the safety of the operation and permit its proper evaluation when separated from these former by too frequent sequelae.

Fairly long survival after diagnosis was reported in from 55 to 65 per cent of the cases, i.e. for from 5 to

25 years and 15 per cent for from 2 to 4 years. 30 per cent of the patients died within 2 years of the onset of symptoms. In Sieber's series of 244 collected cases quoted by Doolin only 18 patients survived the sixtieth year.

In general the patient in whom polycystic disease is diagnosed in the third or fourth decade can expect a much shorter life than the patient in whom the diagnosis is not made until the fifth or sixth decade. This is evidently because cysts grow more rapidly (with symptoms) in the younger individual and, therefore the approach toward renal failure is more rapid. In approximately 50 per cent of the cases of polycystic disease coming to autopsy uremia is said to be the lethal factor. Although it has not yet been possible to study statistically an adequate series of cases since the antibiotics became available in 1945 it is safe to predict that such a study will show less frequent need for surgery, less frequent death from uncontrollable infection and modest prolongation of life through reduced parenchymal damage by infection.

JOHN A. LEE, M.D.

**The Importance of Accurate Pathologic Classification in the Prognosis of Renal Tumors.** N. CHANDLER FOOT and GUSTAVUS A. HENNINGSEN. *Surgery* 94:8 3, 369.

The authors stated that there is a histogenetic, pathologic, and clinical justification for classifying renal tumors into (1) those of mesodermal origin and (2) those of endodermal origin, and that the tumors of the former category have a better prognosis than those of the second category. The tumors derived from the mesoderm are simple adenomas and renal-celled carcinomas (hypernephroma or clear-celled carcinoma) including some tubular forms. The tumors derived from the endoderm are transitional-celled papillomas, transitional-celled carcinomas, epidermoid carcinomas, and some carcinomas of the collecting tubules. (The tumors derived from embryonal tissue are juvenile and adult embryonal carcinomas and mixed embryonal tumors including those of Wilms.)

In a series of 66 renal tumors the renal-celled type of carcinoma outnumbered the other forms 2 to 1. The prognosis of this type of renal carcinoma may be based with a reasonable degree of accuracy upon the microscopic appearance of the tumor. Patients with well-differentiated tumors have a good chance of living 5 or more years. The endodermal neoplasms and those developing in mixed mesonephric nests give an almost hopeless prognosis.

ROBERT TURNELL, M.D.

**Mixed Tumor of the Kidney.** NORMAN J. HICKEL and GEORGE D. PRINCE. *J. Urol.* Balt., 94:3, 59, 372.

The authors reported a rare case of lipomyoma of the left kidney without gross or microscopic hematuria. The greater differentiation of this mixed tumor separates it from Wilms' adenomas and accounts for a better prognosis.

ROBERT TURNELL, M.D.

**Cancer and Tuberculosis in the Kidney (Cáncer y tuberculosis en el riñón).** A. PUIGVERT and A. ORTIZ AMORRUTA. *Arch. ciruj. y med.* 94:3, 4, 300.

Two patients are reported in whom there were a cancer and a tuberculous process associated in the same organ. The authors merely add these case histories to the other 17 so far published without attempting to explain the possibility of an intimate coexistence of the strongly aerobic tuberculous process with the strictly anaerobic cancerous process, a possibility which has been emphatically denied in the past.

The first case was that of a 45 year old male with a long history of pulmonary, epididymal, and urinary tract symptoms suggesting tuberculosis. Hematuria, fever and asthenia had been present off and on for 4 or 5 years. The excised kidney was found to be enlarged, normal in shape but with a huge mass, as large as the kidney itself, riding in hood like fashion on its upper pole. This mass was made up of typical tuberculous tissue but was without trace of other tissue which might give a hint as to the organ from which it took origin. Also scattered in the kidney tissues were small centers exhibiting tuberculous changes. In the middle calyx of the opened kidney pelvis a large tumor mass filling the entire renal pelvis was implanted by means of a sturdy pedicle. In two other locations within the kidney tissue were found small nodules of neoplastic infiltration having the same general histological characteristics as the original mass. This mass on histological examination was found to consist of fine connective tissue strands covered by a single layer of cubical epithelial cells with acidophilic protoplasm. The nuclei were large, spherical or oval in shape, with one or two nucleoli and finely granular chromatin. The diagnosis was papillary epithelioma. However in many areas, the cells were irregularly arranged, tending to multiply by direct division (no mitotic figures) in a straight line so as to form strandlike and tubelike figures.

The second case was that of a 44 year old male complaining of frequent urination and turbid purulent urine. The prostate bladder walls and perimetrial mucosa on the right side exhibited typical durations and ulcerations of tuberculosis. The urine contained tubercle bacilli. The right kidney was enlarged and smoothly globular and descending pyelography presented the appearance of a huge rounded mass pushing the pelvis and calices medially and stretching them vertically. The mass was diagnosed as tuberculosis of the right kidney with exclusion of the lower pole. Upon nephrectomy however it was found that the mass in the lower pole consisted of a cystic degeneration of a Grawitz tumor (hypernephroma). The middle zone of the kidney contained numerous areas with typical tuberculous changes. There were cavitations, caseation, and collections of epithelial and Langhans type of giant cells. One of these tuberculous cavitations bordered directly on one of the epitheliomatous cystic locules, so that between the two there was only a narrow connective tissue septum made up of edematous connective tis-

sue stroma with inflammatory infiltration, and a few muscle fibers corresponding to the muscular strands of the intrapyloric smooth muscle sphincter all in evident process of hyaline degeneration. In the part corresponding to the tuberculous cavitation there were caseous changes and epithelioid and round-cell infiltrations, while on the opposite side of the septum was the cystic cavity lined by neoplastic epithelial elements consisting of large cells with clear protoplasm and large hyperchromic nuclei tending to multiply and extend in an anarctic fashion. In the walls separating the neoplastic cysts from one another were these tumor cells carpeting fine strands of connective tissue stroma. In other areas the distribution of these elements suggested uniliferous tubules. The cystic cavities contained a colloidal substance.

In studying the reports of the 19 cases of association of cancer and tuberculosis in the same kidney the authors find that in 9 the diagnosis was made preoperatively in most instances the kidney was observed to be enlarged but as the tubercle bacillus was discovered in the urine the possibility of the presence of tumor was automatically excluded.

JOHN W. BRENNAN M.D.

**A Case of Primitive Epithelioma of the Ureter** (Un caso de epiteloma de ureter) JOSÉ PONCE ARIAS and NICOLÁS CRISPA PONCE. *Arch. españ. urol.*, 1948, 4, 191.

A 53 year old native of Tenerife, Canary Islands, came to Las Palmas complaining of hematuria and colicky pains in the left flank dating back several months. Cystoscopy and descending and finally ascending pyelography on the left side disclosed two kidneys, pelvis, ureters, and ureteral metastases on the right side and an enlarged kidney with double pelvis and double ureter on the left side. However on the latter side the ureters united at the level of the fourth lumbar vertebra. The shadow of the ascending pyelography exhibited one large shadow defect at the point of union and three other smaller defects further down near the union of the ureter with the bladder. The left kidney and double ureter were removed en bloc through two incisions, one in the left kidney region and the other in the left iliac fossa. A drain was left in each incision and the operative wounds were closed around them. The patient recovered without incident.

The kidney upon being opened disclosed a mural tumor in the kidney pelvis which on histological examination proved to be an epithelioma with large clear nuclei and abundant protoplasm. The nuclei were at times double and contained large deeply staining nucleoli which were also at times doubled. There were no mitotic figures observable. The walls of the ureter at the point of union were very much thickened (2 cm.) and were infiltrated with nests of and isolated epithelial cells which in places came very close to the peripheral surface of the ureter. The three smaller shadow defects lower down corresponded to epithelial implants evidently disseminations from above.

There is only one treatment for this type of ureteral dissemination from a primary tumor of the ureter as found in the author's case in which the other kidney was determined to be functionally efficient, and that is total ureteronephrectomy.

JOHN W. BRENNAN M.D.

**Primary Carcinoma of the Ureter** FRANCIS E. STOCK and CHARLES WELLS. *Brit. J. Urol.* 1948, 20, 19.

Reference is made to a recent comprehensive review of the literature on primary carcinoma of the ureter. Two new cases are reported in detail.

These 2 cases are interesting because neither one was diagnosed when first seen. Case 1 was treated for a long time for what was believed to be a post-prostatectomy cystitis with hematuria. Case 2 was diagnosed as hydronephrosis of unknown origin but associated with an enlarged prostate and was allowed to go untreated on account of the general condition of the patient. In the first case hematuria was the only presenting feature while in the second there was no hematuria at any time and the patient complained only of pain in the loin some months after the hydronephrosis had been discovered. Neither case presented the characteristic triad of symptoms and signs and both patients made an excellent recovery following nephroureterectomy. Histologically both growths were papillary in nature, but in the first the volume of tumor was relatively small compared with the area of its base, while in the second the volume of tumor was large and was attached by a relatively small pedicle, from which plaques of growth could be seen spreading within the ureteral wall.

JOHN A. LOFF M.D.

**Metastatic Tumors of the Ureter** DAVID FREEMAN and LOUIS ERLICH. *J. Urol.*, Balt. 1948, 59, 312.

True metastatic tumors of the ureter are relatively rare lesions. After a careful study of the literature the authors found a total of 37 reported cases with actual spread to the ureter via the lymphatics or the blood vessels from a primary neoplasm elsewhere in the body. Ureteral involvement from direct extension from adjacent organs is not included in this study. The criterion for inclusion in the present study was the demonstration of malignant cells in a portion of the ureteral wall in the absence of any neoplasm in the adjacent tissues. This study included not only the author's cases but also a detailed analysis of the previously reported cases. The site of the primary lesion was the stomach and prostate, each in 8 cases. In the cervix in 3 patients in the bladder, lung, large bowel and ovary each in 2 patients and in 4 patients there was a generalized lymphoma. The ureter, vagina, uterus, and urethra were the primary sites once each in the series.

While the most common symptom was pain in the lumbar region or flank (46%) it was impossible to ascertain a definite syndrome because of the concurrent involvement of the lower urinary tract by the malignant growth in most of the cases. Hematuria occurred infrequently (16%). In 90 per cent of the

patients there were metastases in other organs or structures. The most common sites were the retroperitoneal glands, the mesenteric glands, the bladder, the lungs or pleura, the kidneys, the liver and the spine.

The ureteral site of metastases was as frequently in the upper half of the ureter as it was in the lower half. There was bilateral ureteral metastases in 22 patients (60%). Of the unilateral involvements, 9 occurred in the right ureter and 6 in the left. The bilateral lesions were usually multiple and at different levels of the ureters. The ureteral lesions in 86 per cent of the patients could be felt grossly. The histologic picture of the metastatic lesions was that of the primary tumor. The most common type was adenocarcinoma which occurred in 22 or 39 per cent of the patients. Squamous-cell carcinoma and sarcoma were the next most frequent, with 6 and 3 cases, respectively. There was frequent occlusion of the ureteral lumen in both the localized nodular type and the diffuse infiltrating type of lesion. The finding of newly formed connective tissue interspersed among the infiltrating malignant cell structures in the wall of the ureter was sufficiently prominent to be an important factor in the occlusion of the ureteral lumen.

Two cases of metastases to the ureter are included in this article. One showed metastatic adenocarcinoma to the wall of the ureter. Following the postoperative death, the autopsy report revealed the primary lesion to be in the pylorus of the stomach. The second case revealed ureteral muscular invasion by squamous epithelial carcinomatous cells similar to those found in the right lung.

The authors suggest that although metastatic tumor of the ureter is not a distinct clinical entity it should be considered in the differential diagnosis in patients with obstruction of the upper urinary tract.

PETER L. SCARDINO, M.D.

### BLADDER, URETHRA, AND PENIS

**Toxicity of the Bladder during Spinal Shock.** RICHARD M. NISBET and JACK LAFITTE. *J Urol*, 1948, 94, 89-126.

Injury to the spinal cord produces immediate loss of sensation and complete flaccidity of the striated muscles below the level of the trauma, with retention of urine and subsequent overflow incontinence. Heretofore, primary atrophy of the bladder has been thought to be the cause of the urinary retention that occurs during spinal shock. This assumption has been prompted by the belief that bladder muscle and skeletal muscle behave in the same manner. The bladder is composed of plain nonstriated muscle and the skeletal muscles are composed of striated muscle. The skeletal muscles and plain muscles are innervated by different nervous systems. The motor impulses to the bladder are mediated over the autonomic nervous system. The plain muscle retains its tonicity and even rhythmic contractility when completely deprived of its external innervation. It would be

unusual for the bladder composed of nonstriated muscle, to become flaccid when its motor supply had been interrupted following spinal cord injury or by chemical blockade.

The authors have demonstrated that the bladder does not become flaccid when its motor supply has become paralyzed either by chemical interruption of the nerve supply (tetraethylammonium) or by trauma, but rather the bladder retains its normal tonicity under these conditions. The distended bladder with decreased tonicity in paralyzed patients was not found to be due to the flaccidity associated with spinal shock, but rather to the decompensation resulting from prolonged distention.

Experimental work was carried out by cystometric observations on patients whose motor impulses to the bladder had been blocked with tetraethylammonium ion. Cystometric readings were made in patients in whom both the sensory and motor supply to the bladder had been abolished by spinal anesthesia. Animal experiments were carried out on the dog under light nembutal anesthesia, spinal anesthesia, and following transection and crushing of the spinal cord. Six patients were observed in spinal shock; these patients were placed on indwelling urethral catheter drainage of the bladder shortly after injury to the spinal cord.

From their observations the authors concluded that the urinary bladder muscle maintains its normal tone as well as its ability to accommodate to increasing volumes of fluid at approximately the same intravesical pressure in the condition of spinal shock. The atonic bladder observed in cases of spinal "shock" was thought probably to be due to the retention of urine with over-distention of the bladder for a long period of time, rather than being due primarily to the loss of the segmental reflex arc concerned with micturition.

The observations recorded in the article tend to suggest that bladder tonus is normal during the period of spinal shock provided that retention of urine with distention is not allowed to take place.

CONRAD A. KUHN, M.D.

**Vesical Dysfunction.** JOHN L. ENNETT and JOHN B. BRACE. *J Am Med Ass* 1948, 36, 693.

In 1911 the authors reported on a study of vesical dysfunction in cases of tabes dorsalis and analyzed the results of transurethral resection in 35 of the cases. In these cases the results of transurethral resection were very good. Recently they made a follow-up study of these 35 cases and of 44 additional cases of tabes dorsalis in which transurethral resection had been performed since December 31, 1940. These 2 groups of cases form the basis of their report.

It must be emphasized that it is impossible in every case to distinguish accurately vesical dysfunction caused by the tabetic state alone from that which results from hypertrophy of the prostate gland or other obstruction of the vesical neck in a case in which tabes dorsalis is only a coincidental finding and of no urologic importance. It is true that the ex-

tremes of these conditions are quite easily recognized but intermediate conditions may be difficult to classify. The chief reason for this difficulty lies in the basic neuromechanics and obstructive factors involved in the disability.

It is the authors' impression that most of the urinary incontinence in tabetic patients may be explained in two ways: (1) overflow from a distended bladder and (2) involuntary micturition caused by reflex emptying of the bladder not properly controlled by the suprasegmental conditioning reflex, the sensory components of which have been damaged. To put it simply, since the patient is not aware that micturition is about to occur, sufficient inhibitory impulses are not sent down from the conscious or subconscious level to prevent it.

It is apparent therefore that the over all problem of vesical dysfunction in tabetic patients is composed of three rather ill-defined parts, namely: (1) vesical dysfunction arising primarily from the neurogenic lesion caused by the tabetic state, (2) obstruction of the vesical neck in a case in which *tabes dorsalis* is only a coincidental finding and plays no part in the vesical dysfunction and (3) a combination of both factors. It is the writers' opinion that most instances of vesical dysfunction belong in the last group.

It is the opinion of the authors that vesical dysfunction associated with *tabes dorsalis* is no longer a therapeutic problem of any importance since consistently good results may be obtained by means of transurethral resection of the vesical neck. The explanation of how transurethral resection corrects vesical dysfunction in this disease seems relatively simple although some points are more or less theoretic. The elimination of residual urine is brought about by weakening the vesical neck sufficiently to permit the weakened atonic bladder, aided by intra-abdominal and if necessary manual compression to expel the urine completely. The elimination of the residual urine also relieves the incontinence in cases in which the patients are suffering from an overflow type of incontinence. The explanation of the relief of incontinence that is principally an involuntary type of micturition also seems fairly simple. The elimination of residual urine increases the reservoir capacity of the bladder. The patient is instructed to micturate regularly every 3 or 4 hours to prevent undue distention of the bladder so that the chance of involuntary micturition is minimized. He is instructed to take the time and make the effort to empty his bladder completely at each micturition. In some cases in which advanced sensory damage is present, the patients never may regain the desire to micturate. Such patients must be carefully taught to micturate at regular intervals and not to wait for the desire to micturate. Inasmuch as the bladder is emptied completely at each voiding the urine may be kept free of infection therefore for all practical purposes the vesical function may be considered normal.

A word of caution is given. Inasmuch as small degrees of obstruction of the vesical neck can precipi-

tate vesical dysfunction in cases of *tabes dorsalis* small degrees of postoperative contracture may conceivably cause a recurrence of the obstruction. Because of this, such patients should be re-examined at yearly intervals to determine if any residual urine is present. If it is, cystoscopic reexamination of the vesical neck should be performed and any scar tissue should be excised.

**Diverticula of the Bladder; A Contribution to Diagnosis and Treatment (Divertículos vesicales, Aportación a su diagnóstico y tratamiento)** ANTONIO PUIGVART GORIO. *Medicina* Bogotá, 1947, 9: 109.

Urinary obstruction involving the urethra or neck of the bladder should be taken care of first, especially if it is of such a character as to render cystoscopy difficult or impossible. Roentgenologic examination should consist of descending pyelography which shows the functioning of the ureter. The ureteral catheterization with the opaque catheter is dispensed with for the diagnosis. When the opening into the diverticulum is located the cystoscope with the mirror set at 135 degrees, so as to view the end of the instrument itself, may be introduced as easily into the diverticular cavity as into the urinary bladder itself. By this means the interior of the abnormal cavity may be cleaned out and treated, and this with the cure of the urethral obstructive phenomena may be sufficient to render the patient comfortable without surgical interference.

However if surgical interference is indicated the author goes in suprapubically, either through the midline incision or by means of a lateral abdominal incision as may be indicated in the individual case and liberates the bladder from the peritoneum. This is done by the method described by Voelcker. If the peritoneum cannot be totally loosened from the bladder cupula, even with the snapping out of some of the superficial muscle fibers of the bladder in the process. A preliminary seminal vesiculography through an inguinal exposure of the vas deferens having clarified the relationship—usually intimate—of the diverticulum to the vesicles and vas, the diverticulum is dissected loose either from the cupula to the neck or vice versa. The neck of communication with the bladder is cut through between two ligatures and the opening into the bladder is closed in the usual manner.

If the removal of the diverticular sac seems too hazardous a marsupialization of the sac to the abdominal skin surface with diathermy coagulation of the lining mucosa may be done through a separate incision removed from the suprapubic incision, however the author does not favor this method as it protracts the cure and at times gives rise to hemorrhage. In the dissection of the sac the fluid content of the bladder and sac is controlled by an assistant through a urethral catheter, however the bladder is never entirely filled as the fluid content may be displaced by localized pressure from the sac to the bladder or vice versa. After the sac has been dissected out, the



bed from which it was removed is carefully inspected, the ureters, especially, are subjected to careful scrutiny and if there be the least doubt as to the circulatory integrity of any portion of a ureter an immediate ureterocystostomy is done.

If the diverticulum was rather highly placed on the posterior wall of the bladder the suprapubic drainage will probably be enough; on the other hand when the sac is located low down toward the pelvic floor the transperineal paraurethral incision for drainage, as described by Illyes, is added. The bed of the removed sac is then dusted with sulfonamide and the suprapubic incision is closed around a rubber tube and two gauze drains. An indwelling catheter in the urethra is employed for a considerable period in the after care of the patient.

JOHN W. BIRNBAUM, M.D.

**Persistent Priapism.** HAMILTON BAILEY. *Br J Surg* 91:3, 35, 98.

Causes of priapism are: erosive lesions, vascular lesions, and secondary carcinoma.

**Priapism due to erosive causes.** Persons executed by hanging have long been known to develop priapism. In 1823 Surgeon Major in the French Army observed in one day 4 executions by hanging. At the moment of strangulation the penis became suddenly and forcibly erect in all cases; it was still half erect one hour after death.

Lesions of the spinal cord, particularly traumatic lesions, are occasionally complicated by priapism. Diseases of the central nervous system, such as syphilis and multiple sclerosis, are cited in the literature as giving rise to priapism. Excessive doses of aphrodisiacs may produce the condition and yohimbine produces the only form of priapism in which the corpus spongiosum is more involved than the corpora cavernosa.

**Priapism due to vascular causes.** The erection in these cases is maintained not by contraction of the erector muscles, which obstructs the venous return by pressure from without but by clotting within. It is believed that clotting commences behind the erector muscles in the formed veins that connect the venous honeycomb of the phallus with the pelvic plexus. There are frequent postmortem records of thrombosis of the deep pelvic veins in cases of persistent priapism. Thrombosis of the deep dorsal veins is the most usual cause of vascular priapism inasmuch as in 5 of 6 cases the corpora cavernosa alone are involved. When the spongiosum and glans share in the erection, the thrombosis is presumably more widespread.

Twenty per cent of cases are associated with a leucemia or sickle-celled anemia which alters the clotting mechanism. Trauma can cause thrombosis. In some cases there is no doubt that priapism followed an accident such as a fall astride. Focal sepsis is a leading cause of thrombophlebitis, yet this is an infrequent cause of thrombosis in the pelvic plexus.

The penis is usually maintained at an acute angle with the pubis. The pain is variable, in some in-

stances so great that heavy doses of narcotics are required for many days. Palpation of the glans penis usually reveals softness as compared with the solid induration of the corpora cavernosa. In 90 per cent of cases the spongiosum is not involved. The condition may occur at any time of life. Young patients are usually sufferers from leucemia or sickle-celled anemia. The elderly group includes most of those in whom a deposit of neoplastic cells is the cause of priapism.

Priapism due to lesions of the central nervous system are usually relieved by low spinal anesthesia. The surgical methods of treatment include aspiration of the corpora cavernosa, which is accomplished by the insertion of a needle into the shaft of the penis and aspiration of the stagnant, thick blood, and by repeated injection and aspiration of saline solution, removal is accomplished. Following partial or complete deflation a firm bandage is applied. It should be noted that it is highly probable that the condition will recur and the procedure must be repeated in from 24 to 48 hours. At least 3 treatments are usually required.

Incision is used in some instances and according to the author more successes have attended this procedure than aspiration. Even so, it is by no means a panacea. The author states that it is a great mistake to sew up the incision after blood and clots have been evacuated as a hematoma frequently forms inviting infection, gangrene and septicemia.

Both of the author's patients, treated by incision, developed gangrene despite aseptic technique. From his study of the subject he recommends incision (1) when aspiration has failed and (2) when the priapism has been present for a week or more. The operation should be carried out under general anesthesia. The incision should be not more than 0.5 inch long; it should penetrate to the center of the crus a little behind the middle of the shaft of the penis. A small hemostat is introduced into the incision and by its and clots are evacuated by squeezing. A drainage tube is stitched in place and after sulfanilamide powder is sprinkled into the wound the penis is surrounded by a liberal damp antiseptic dressing. Prophylactic penicillin therapy is commenced at once.

The author believes that dicoumarin should be prescribed, although there is no record that it has been used in this condition. The author describes 3 cases treated by incision in which gangrene developed. The first case occurred in a man of 73 following an incision and closure. A hematoma formed which became infected and gangrene ensued. Despite amputation the patient died of septicemia. The second case was that of a man of 55 in whom an incision was made and ligation of the dorsal arteries and suprapubic cystostomy were carried out. On the fifth day it was evident that gangrene of the penis was commencing. Amputation was done the following day and his subsequent progress was satisfactory.

ROBERT O. BRADLEY, M.D.

## GENITAL ORGANS

**Carcinoma of the Prostate with Skin and Bone Metastases Treated with Estrogens** (Carcinoma prostatico con metastasi cutanee ed ossee trattato con estrogeni) GIOVANNI BARENCHI. *Minerva med.* Tor. 1948, 39: 108.

A 54 year old man whose father had died of a gastric, and his mother of a uterine, neoplasm, had suffered vague back pains and mild attacks of fever for more than a year which had been treated at various times as rheumatism and malaria. He was quite emaciated and anemic when first seen. There were multiple nodosities scattered over the skin of the upper back and chest regions. These nodules were freely moveable in the subcutaneous tissues, measured from 3 to 4 to 8 to 10 mm in diameter and had no clearly defined borders. They were painless and the skin over them was unchanged. The eyes of the patient protruded somewhat, his eyelids were edematous, his pharynx was reddened and his tonsils were enlarged and irregular. Signs of pericardial and left pleural effusions were present. Both the liver and spleen were enlarged. Roentgenologic examination disclosed extensive osteoplastic shadows of the vertebrae, clavicle, sternum and ribs which suggested neoplastic metastases. The mediastinal lymph glands were noticeably enlarged. Palpation of the prostate and a vesiculographic examination disclosed a prostatic neoplasm. Biopsy of one of the nodules on the thorax confirmed the diagnosis of metastasis from a prostatic adenocarcinoma. In the succeeding 3 months the condition progressed in exorbitant urinary retention appeared the skin nodules grew steadily in size and new ones appeared over the neck, face, scalp and abdomen. The patient was bedridden, stuporous, and apparently in extremis.

Daily injections of the synthetic estrogen 4-A dipropionate of alpha beta diethylstilbene in 0.4 mgm. doses were started and after a total of 2.8 mgm. had been given the skin nodules were noted to be appreciably smaller and no new ones had appeared. Under this treatment the patient put on weight and could leave his bed, the pericardial and pleural effusions disappeared and the liver returned to normal size. One of the nodules were excised and histological study showed that in the superficial layers there were no cancer cells but odd-looking spaces suggesting fluid pockets which replaced the vanished neoplastic tissue. Cancer cells were found deeper but these exhibited various signs of degenerative changes. The prostate now seemed reduced in size and was less hard and irregular. This same appearance of regression was also portrayed by the roentgenologic appearance of the bone and mediastinal metastases. At a later period while the synthetic estrogen was unavailable 2 new nodules developed on the head but no regression was noted under a total dosage by injection of 5 mgm. of the natural estrogen dihydrofolliculin benzoate. About a week after this treatment was stopped 2 new nodules and some red spots (new

nodules) appeared and the urinary disturbances recurred however with renewed synthetic estrogen in 1 mgm. daily injections the urinary symptoms regressed rapidly and the skin nodules and reddened areas began to disappear. These regressive and renewed periods of progression of the process occurred because of refusal of the patient to take the treatment continuously or to receive large doses for 6 months at which time he left the hospital and was thenceforth treated at home. Here the injections were somewhat irregularly carried on some bone metastases developed which did not seem to respond to the drug and the patient died a little more than a year after beginning treatment.

The author thinks that on the whole the progress of the case suggests a hormonal character in view of the therapeutic results procured in this case. It is true that the lack of response to the natural preparation suggests that the efficacy of the synthetic preparation depends upon some other than the hormonal component however the treatment with the natural estrogen was not carried out sufficiently long or in sufficient doses to allow of any definite pronouncement concerning its efficacy.

JOHN W. BRENNAN, M.D.

**Tumors of the Testis.** LLOYD C. LEWIS. *J. Urol.* Balt. 1948, 59: 763.

The varied structure of tumors of the testis suggested to the authors that no one method of treatment was adequate to control this type of cancer. Forty three per cent of 250 patients admitted to Walter Reed Hospital, Washington, D. C., had proved metastasis at the time of hospitalization and in addition 28 per cent of the patients eventually developed metastasis. Only a few patients with cancer of the testicle could be cured by simple orchectomy. Orchectomy and radiation therapy proved to be a satisfactory form of treatment only in cases of seminoma.

The seminoma behaves as a clinical entity having the features of relatively slow growth, delayed metastasis and remarkable radiosensitivity. The prognosis is usually good in this type of tumor. The seminoma is a rounded, lobulated, solid, grayish white tumor which tends to compress but rarely invades the seminiferous tubules. Seminoma occurred in 109 or 43 per cent of the reported cases. Seminoma is usually found in the atrophic or maldeveloped testis. Twelve of 13 tumors in cryptorchids were seminomas. Seminomas were also found in 3 patients with traumatic or idiopathic atrophy. The author found the incidence of tumors of the testis in undescended testes to be 22 per 10,000 occurring 22 times as commonly as seen in the normally descended testes. Neither orchiopexy nor spontaneous descent of the testicle have any lessening influence on the development of tumor in a cryptorchid patient.

The classification of testicular tumors suggested by the author was based upon the embryonal form, pathological structure, radiosensitivity studies and

the results of combined surgical and radiation treatment that were carried out at the Walter Reed General Hospital.

At the onset and for many months tumor of the testis may represent a painless swelling of the testicle itself. Later expansion of the capsule or trauma may produce pain. Hemorrhage may also produce pain, but the history of acute painful swelling with redness and fever characteristic of inflammatory lesions of the testicle is lacking and these symptoms may help to make the differential diagnosis between tumor of the testicle and a benign condition.

Patients with chorioepithelioma may have symptoms referable to metastatic involvement and there is no testicular mass that can be palpated. Seminoma rarely metastasizes without a palpable tumor of the testicle being present. Hormone bioassays by the modified Aschheim-Zondek technique were considered to be of little diagnostic value and positive tests were considered as confirmatory evidence only when a tumor of the testis was present, or metastasis was obviously present. Thirty-five per cent of a series of control patients without tumor of the testicle gave positive readings to the Friedman test. Thirty-four per cent of the patients with seminoma who should have secreted no gonadotropins had high readings. A positive test cannot, therefore, be interpreted as evidence of testis tumor nor of metastasis. A repeatedly confirmed positive reaction from a patient with tumor indicated a likelihood of chorionic thumors being present in the tumor.

Bimanual palpation will help to make the differential diagnosis between tumor of the testicle, epididymitis, lesions of the spermatic cord, spermatoceles and lesions of the surrounding scrotum. It may be necessary to aspirate a complicating hydrocele before the testicle can be examined. When a differential diagnosis cannot be made exploration of the scrotum is imperative. Punch or needle biopsies as a means of diagnosis are condemned by the author.

Orchiectomy by the inguinal approach so that the incision can be extended to perform the radical retroperitoneal dissection after gross examination of the tumor has been done, was advised by the author. He preferred the radical orchiectomy for any type of testis tumor. Chorionic tumors metastasize by the lymphatics as well as the blood stream therefore radical surgery in chorioepithelioma must include the long internal spermatic vessels along with the lymphatics. Lewis considered the radical orchiectomy to consist of the removal of the testis with its tunica, the epididymis, the entire spermatic cord and the retroperitoneal lymph chain from the inguinal ring to the renal pedicles. Crossed metastases below the renal pedicles were not observed except when there was a tremendous involvement of the precaval nodes from tumor of the right testicle. Metastases from testicular tumors may skip nodes, may even skip all of the retroperitoneal nodes and appear at the supraclavicular node on the left side. Chorioepithelioma may invade the blood stream without lymphatic involvement. On the left side the lymphatic

chain and nodes lie lateral to the aorta and pass up to the nodes at the entrance of the internal spermatic vein, thus entering into the left renal vein. Those nodes at the renal pedicle and medial to the pedicle are most frequently involved. On the right side the lymphatic pathways lead over the vena cava between it and the aorta to the most frequently involved node at the entrance of the internal spermatic vein into the vena cava. Metastatic channels lead to midline inoperable nodes situated above the renal pedicles.

The author stated that he had performed 169 radical retroperitoneal resections without operative mortality. Sixty-six per cent of the patients had no metastatic involvement of the nodes and 24 per cent of the patients had operable metastatic nodes, which were removed. In 10 per cent of the cases the nodes were found to be inoperable. Seminomas were found to be the most radiosensitive, some embryonic tumors were markedly affected by a dosage of from 2,000 to 3,000 roentgens. Chorionic tumors were not effectively changed by roentgen therapy and irradiation of metastasis was considered to produce most discouraging results.

Roentgen therapy to be effective, required the use of a full lethal tumor dose. Prophylactic irradiation of the retroperitoneal area or of other specific areas required specific lethal tumor dosage. Using the millifton volt x-ray machine it was discovered that the patients could take a large dosage and survive the immediate impact from the treatment. Some of them later developed radiation gastritis and late radionecrosis. Fourteen patients had perforated stomach and bowel  $1\frac{1}{4}$  to 3 years following therapy. The relatively small lethal dose for seminoma can be delivered to the area of the retroperitoneal nodes with safety 1,000 roentgens were considered adequate. It was not considered safe to use prophylactic irradiation for tumors which required more than a 3,000 roentgen lethal tumor dose. All patients requiring more than 1,000 roentgen units for prophylactic irradiation required the radical retroperitoneal gland dissection.

In conclusion, the author states that the treatment of tumors of the testis must be varied according to the type of the pathology. Simple orchiectomy was sufficient for benign interstitial cell tumors of the testicle. In teratoma of the testicle radical orchiectomy without radiation therapy was indicated. Simple orchiectomy plus radiation therapy was sufficient in the treatment of seminoma. One thousand units as a prophylactic dose were indicated also for seminoma, but the information gained by retroperitoneal dissection of the lymph nodes aided the roentgen therapist in planning the subsequent roentgen treatment. For undifferentiated carcinoma, adenocarcinoma, and papillary adenocarcinoma, radical orchiectomy was indicated followed by prophylactic roentgen therapy not to exceed 3,000 roentgens. For trophoblastic tumors, choriocarcinoma, and chorioepithelioma, radical orchiectomy and radiation therapy in dosages of 5,000 roentgens were used except when

Inoperable metastatic nodes remained. For teratoma and malignant embryonic elements, irradiation was indicated only when inoperable metastatic nodes were found.

CONRAD A. KUEHN, M.D.

# MISCELLANEOUS

The Significance of the So-Called Reaction of Decompression in Chronic Retention of Urine  
*ANNALS OF SURGERY*, 1948, 96: 297

In patients with chronic retention of urine, sudden evacuation has long been regarded as an erroneous procedure because of the likelihood of the development of symptoms from the bladder in the form of hemorrhage, from the kidneys in the form of further impairment of their function, and from the circulation in the form of a fall in blood pressure. More recently, however, certain authors have become convinced that evacuation of a chronically distended bladder is dangerous only when the kidneys do not have a sufficient quantity of liquid at their disposal. In patients who were well hydrated, neither anuria nor uremia were noted.

In the University Clinic at Oslo, Norway, it has been routine for many years to perform cystostomy in the course of the first couple of days on patients suffering from great chronic retention of urine. The patients are copiously supplied with liquids and are placed on a diet which is poor in nitrogen.

The author examined the reactions of decompression in 150 patients who had undergone this method of treatment. Fifty-eight of these patients with retention of over 400 c.c. of urine, most of whom had a considerable increase of urea nitrogen, were treated by cystostomy in the course of the first couple of days after admission. On admission the bladder was completely emptied with the use of a catheter; the method of gradual decompression was not adopted. In all but 2 cases the cystostomy was followed by copious diuresis and a decline of the serum urea. In 1 case a marked reaction of decompression with a considerable rise in serum urea was observed. This reaction was transient and without permanent injurious effect.

The second group of 42 patients had a serum urea of under 50 mgm per cent and the majority of these had a residual urine of less than 400 c.c. The diuresis which followed emptying of the bladder in this group was less pronounced than in the preceding group and no reaction to evacuation was noted. In the third group 53 patients were cystostomized following previous repeated catheterizations. The majority of these patients had been catheterized at home and the serum urea and residual urine content before catheterization were therefore unknown. These cases were not regarded as suitable for study.

From his experience with this material the author concludes that rapid decompression of the chronically distended bladder is not dangerous if the patients are copiously supplied with fluids and kept on a diet which is low in nitrogen.

ROBERT O. BEADLER, M.D.

Fertility in Men ROBERT S. HORTON, *J. Urol.* Balt., 1948 59: 149.

The magnitude of male infertility is discussed. It is estimated that there are one and one-half million involuntary barren couples in the United States and that one-third of the unproductive marriages may be assigned to male faults. Thus there are one-half million husbands in the country deserving of diagnosis and treatment.

With reference to experimental and investigative work, it is pointed out that because of structural and physiological differences, information gained from animals is not applicable to the human. The work of MacLeod is mentioned from which it would appear that the essential requirements for the sperm to continue activity are an isotonic fluid and some available source of carbohydrate. The seminal vesicles supply the sugar and the prostate produces the enzymes responsible for the lysis of the semen. Moore and Gallagher demonstrated in the castrate that it takes three times as much androgen to sustain the seminal vesicles as the prostate. Heckel and Steinets showed that estrogens in the male reduce the amount of the ejaculate. Mann has suggested that since the seminal fluid contains fructose these organs must extract glucose from the blood stream and convert it to fructose. In spite of this knowledge of the prostate there is still much to be desired concerning the physiology of the prostate and seminal vesicles.

The function of the vasa and epididymes is not known, but they are apparently more than reservoirs since, as Munro has pointed out, in the rooster the hatching took place with fertilization of sperm aspirated from the testicle in 0.7 per cent of epididymal sperm in 3.5 per cent, and with sperm removed from the ampullae of the ductus deferens in 63 per cent.

Clinically it has been shown that ectopic testicles not brought down into the scrotum prior to puberty always result in sterility. Another cause of barrenness is infrequent coitus. This is borne out by the figures of Pearl who showed that between the ages of 20 and 29 years intercourse was practiced on an average of 202 times before pregnancy took place, between the ages of 30 to 39 on 190 occasions, and between 40 and 49 years on 1434 occasions prior to pregnancy. The misconception as to the time of ovulation and related coitus also accounts for some instances of barrenness.

The need of accurate tests for seminal deficiencies is well recognized. At present we have available the metabolism test to demonstrate thyroid deficiencies and a test for follicle stimulating hormone (FSH) which suggests pituitary dysfunction and permits some estimate as to whether the testicular deficiency is primary or secondary.

As to therapy the commercial preparations of hormone are grossly unreliable and too antihormones may be formed in the body so that continued hormonal therapy becomes decreasingly effective. Such an enzyme as hyaluronidase is apparently of importance and its concentration in the ejaculate is directly proportional to the number of sperm but there is no

direct evidence that it is essential for fertilization of the ovum. The clinical evaluation of this enzyme in sterility is not established.

ROBERT LEON, JR., M.D.

Oxycel in Urology. ALBERT E. GOLDSTEIN and ARTHUR HOLLANDER. *J Urol* Balt., 948 59. 195

Oxidized cellulose gauze was used as a hemostatic pack in 50 urological cases at the Sinai Hospital Baltimore Maryland. The authors state that there is no question but that it is a valuable adjunct to their present methods. They have found the gauze to be a good hemostatic agent in many areas in which they preferred not to use sutures or in which there was a generalized ooze. However it must be emphasized that where there is an obvious bleeding point, the safest hemostatic agent is the ligature or the suture-ligature. The hemostatic property of oxycel is most dependable when it can be given constant supportive pressure; thus, in the kidney it should be reinforced with a mattress suture, and in the suprapubic prostatic fossa it should have a regular gauze pack behind it. The perineal closure should be strong enough to give it support.

The authors have not been impressed with the absorbable property of oxycel. In their experience gauze becomes black when it touches blood and is quickly converted into a soft, amorphous mass. Within 24 hours, this mass has begun to disintegrate into large and small granules which drain from the body through the nearest exit—the urinary tract or the wound itself. Oxycel drainage retard complete

# USE OF OXYCEL FOR HEMOSTASIS IN GENITOURINARY SURGERY

	Cases
Two stage suprapubic prostatectomy	20
Perineal prostatectomy	5
One stage suprapubic prostatectomy	4
Radical Perineal prostatectomy	
Excision and fulguration of bladder tumors	3
Perineal fistula	
Perforated bladder	
Diverticulectomy	
Nephrectomy	
Heminephrectomy	
Nephrothotomies	3
Adrenal tumor	1
Retroperitoneal sarcoma	1
Nephrocystostomy anastomosis	1
Biopsy	
Postoperative hemorrhage	
Renal exploratory	
Suprapubic cystotomy	
Postoperative nephrectomy	1
<b>TOTAL</b>	<b>59</b>

healing and may increase urinary drainage; the possibility of wound disruption and fistulous tract formation is enhanced by its use. In suprapubic prostatectomies, the granules are discharged through the urinary tract and the wound. Until they are completely drained from the urethra or are mechanically removed with a sound and sodium bicarbonate, they act as obstructions and cause delay in voiding. Because of this persistent drainage, complete wound healing is retarded.

JOHN A. LOFF, M.D.

# SURGERY OF THE BONES, JOINTS, MUSCLES, TENDONS

## CONDITIONS OF THE BONES, JOINTS, MUSCLES, TENDONS, ETC.

**Rare Case of Circumscribed Osseous Rarefaction of Elbow following Trauma of Corresponding Shoulder and Probably Attributable to a Lesion of the Parasympathetic Fibers of the Brachial Plexus** (Raro caso di rarefazione ossea localizzata al Plexus (Raro caso di rarefazione ossea localizzata al gomito conseguente a trauma esercitato sull' spalla omologa, e riferibile con grande probabilità ad intossicazione delle fibre parasimpatiche del plesso brachiale) PAOLO ZOBOLI *Bull Soc med chir Modena*, 1947 47 91

Following severe trauma a man aged 22 sustained a fracture of the neck of the right scapula. Subsequently paralysis of the corresponding brachial plexus developed causing severe pain and absence of various types of sensibility in the entire extremity. Ten days after immobilization the patient developed pain in the right elbow which assumed a purplish color showed an increased local temperature, and became edematous. Roentgenograms revealed a circumscribed rarefaction of the bones of the elbow especially of the lower end of the humerus and the upper end of the ulna.

There were no signs of generalized osteoporosis or a similar process in the region of the trauma. The following conditions were considered and excluded: osteomalacia, Recklinghausen's fibrous osteosis, Paget's fibrous osteosis, post traumatic osteolysis or Sudek's atrophy and syringomyelia or essential osteolysis. The author came to the conclusion that the circumscribed rarefaction of the bones was attributable to the involvement of the parasympathetic fibers in the brachial plexus. Following paralysis the resulting hypertrophy or atrophy of muscles the involved tissues are an easy prey to avitaminosis and vasomotor disturbances. Prolonged immobilization for about 30 days had probably contributed to the condition.

JOSEPH K. NARAT M.D.

**Styloiditis of the Radius (Styloidite radiale)** LUCIEN LECHE and P. GAUTHIER VILLARS. *Presse Méd.*, 1947 No. 74 858.

The 6 cases of swelling and pain on motion and pressure over the lower end of the radius when added to the 3 reported by Veyrassat and 3 reported by Mouchel seem to be all of the cases of styloiditis of the radius which have been published so far. Five of the authors' patients were women ranging in age from 30 to 60 years, and 1 patient was a man of 36 years.

The occupational nature of the malady seems substantiated in that the symptoms involved the right wrist of all the patients except 1 of the women who was left handed. Five of the authors' patients submitted to the operation of trephining and curetting out the underlying cancellous and marrow tissues of

the styloid process and all were completely relieved of the pain. The sixth refused operation. The roentgenologic examination disclosed a distal radial epiphyseal disturbance in bony structure. Under physics with disturbances in bony structure appeared the thickened periosteum, the bony cortex appeared thinned and the density of the styloid process diminished. This porotic appearance however was not accompanied by any modification of the bony trabeculae. The patches of decalcification were so sharply delimited as to give the appearance in one case of a cystic cavity in the bone.

The curetted bone specimens exhibited in 2 instances an evident periosteal reaction, consisting of general fibrous changes and a tendency toward osteoid formation. Here the superficial disturbances of ossification were the only pathologic phenomena noted. In a third case multiple and ramified erosions could be seen. In the remaining 2 patients periosteal lesions were not noted but there were some thickening of the osseous lamellae and a mild degree of medullary fibrosis. In no case was there evidence of vascular dilatation or infiltrative cellular signs of tissue inflammation.

The etiologic theory of Veyrassat, who believed that the condition was due to multiple irritative pull on the styloid by the insertion of the ligaments and tendons at this site especially the supinator brevis tendon is tentatively accepted however the authors note that the supinator longus is also inserted near this point and suggest the theory of a malady of supination.

JOHN W. BRENNAN M.D.

**The Sternum of the Child. Radiological Studies of Its Developmental Anomalies** (Le sternum de l'enfant. Étude radiologique des anomalies de son développement) M. HENRIKSEN. *Rev. orthop. Par.* 1947 33 475.

The sternum is visible on roentgenograms even in very young infants and the author outlines a method by which the sternum can be visualized. The body is bent forward the head is elevated the shoulders are pulled back and up and the sternum is kept in the center without any torsion of the thorax.

The shape size and number of the ossification centers of the sternum indicate precisely the age of the skeleton. The manubrium of the sternum has only one center of ossification at the time of birth. The body of the sternum usually has eight ossification centers. The most proximal pair of ossification centers appears in the seventh or eighth fetal month. Between the ages of 1 and 2 years the two most proximal centers fuse and the most distal four ossification centers appear. Between the ages of 2 and 3 all four pairs of ossification centers fuse and form four large centers. In older children the density of the center increases and is better visualized on the roentgenogram. The xiphoid process develops its center of ossification between the ages of 10 and 20.

The centers have a certain size density and a definite time when they fuse which corresponds to a definite age of the child, but these conclusions can be accepted only in the absence of dietary deficiency states, rickets, or growth disturbances.

Decalcification of the ossification centers was observed in severe pulmonary tuberculosis. Premature fusion of the ossification centers of the sternum may give rise to deformities of the thorax.

GEORGE I. REIMS, M.D.

**Osteochondroma of the Ribs in a Child Suffering from Osteogenic Disease (Osteochondroma costal chez un enfant atteint de maladie ostéogénique)**  
J. MATTHEY, M. BLONDEAU and A. LEHMANN. *Presse méd.*, 1947 No. 74 872

Roentgenograms of a boy of 12 years had shown tuberculosis of the hilus, first of the right, then of the left hilar regions, about 5 years previously. Six months later an exostosis of the right humerus appeared and during the following years there was evidence of a torpid growth. Three years later there appeared on the left side a round homogeneous, sharply circumscribed shadow lying subjacent to the posterior arch of the third rib. This mass grew rapidly in size, quadrupling itself in 9 months. On a roentgenogram the mass appeared roughened, indented, and containing lighter areas rather like cysts. In a special position, that is, with the back strongly arched and rotated toward the right and the scapula displaced laterally thus showing the tumor with the rays tangential to the curve of the thoracic contour the parietal character and the costal origin of the tumor could be determined. Erosion of the third rib was evident.

The tumor was removed from behind, through an incision encompassing the scapula. With the tumor were resected the posterior area of the third and fourth ribs. The surgeon was able to preserve intact the pleural covering of the mass. Two months later the boy was in perfect health, and the roentgen study failed to disclose local recurrence or metastasis.

On histologic examination the tumor was found to be covered with a thin fibrous capsule and to consist of cartilaginous tissue with stellate cells. The different areas of the tumor were of widely differing densities: certain zones were almost liquefied (diminished roentgen shadow density). Scattered through the mass were spicules of bone formation bordered by a certain number of osteoblasts.

The authors have reported this case because they believe—and they cite Vossa in support of their belief—that every case of association of osteochondroma with osteogenic disease, especially in a child, should be reported.

JONAS W. BRIDGMAN, M.D.

**Calcification of Intervertebral Discs (Disco calcifiante intervertebrale)** CH. LAMERIE and G. PEXILLIOT. *Rev. orthop.*, Par 1947 33: 464.

Calcification of the intervertebral discs occurs with in the nucleus pulposus or in the annulus fibrosus where occasionally actual ossification may take place.

The anterior portion of the annulus fibrosus is composed of fibrous bands which extend from the distal surface of one vertebra to the proximal surface of the underlying vertebra. They are firmly imbedded in bone by means of Sharpey's fibers. These fibers may break because of trauma or latent infection and defects occur within the annulus fibrosus. Osteogenic fibrous tissue fills these defects and "intercalary bones" develop. Preceding the formation of osteophytes or intercalary bones, changes within the annulus fibrosus are necessary.

Calcifications of the nucleus pulposus are incidental findings on roentgenograms and have no clinical significance. Any associated subjective signs are usually due to some underlying cause other than the calcification of one or several nuclei pulposi. The nucleus pulposus maintains its own blood supply up until the age of 25 and it is possible that an infection may reach this area. The calcification indicates a healing stage of an old focus of infection.

GEORGE I. REIMS, M.D.

**Morphologic Variations in the First Sacral Vertebra in Cases of Lumbalization (Variaciones morfológicas en la primera vértebra sacra en los casos de lumbellización)** L. GÓMEZ OLIVEROS. *Ciruj. per locomotor* 1947 4 308.

The author made special studies of 100 vertebral columns and found 3 cases of sacralization of the fifth lumbar vertebra and 5 cases of lumbalization of the first sacral vertebra. He accepts the Dubreuil-Chambardel classification of this disturbance into three grades, depending upon whether the vertebra is a completely separate unit or whether it is fused to the sacrum in some manner.

This condition interferes with the dynamics of the vertebral column and may be the cause of lumbar pain, sciatica, scoliosis, and many other backache complaints.

STEPHEN A. ZIEGLER, M.D.

**Pes Planus or Instability of the Longitudinal Arch.** GEORGE PERKINS. *Proc. R. Soc. M. Lond.*, 948, 41 31.

The condition of flatfoot, or instability of the longitudinal arch (as the author believes it is more correctly termed) cannot be properly understood without a clear understanding of the respective functions of the muscles, ligaments and bones the structure of the longitudinal arch and the manner in which the stability of the arch is normally preserved.

For the longitudinal arch to be stable, two conditions must be fulfilled: (1) the body weight must pass through the center of the subtaloid-mid tarsal joint, and (2) when the body weight is being transmitted through the center of the subtaloid-mid tarsal joint, the foot must be plantigrade. I.e., all three bearing points must be on the ground.

The muscle-ligament reflex balancing mechanism is gradually acquired during the first year or two of life. Occasionally the postural activity of muscle as regards the subtaloid-mid tarsal joint is never acquired, and the longitudinal arch remains unstable.

throughout life the foot collapsing into planovalgus whenever the person stands. The three main causes of pes planus are (1) faulty postural activity of the muscle (2) an equinus deformity of the whole foot, and (3) a varus deformity of the forefoot.

From the point of view of treatment four types of pes planus deserve recognition. These types and the treatment recommended for each are as follows:

1. Mobile pes planus due to faulty postural activity of the muscle. Treatment recommended for this type is to make the patient rotate the legs out wardly while keeping the feet flat on the ground and making him stand and walk pigeon toed.

2. Mobile pes planus due to an equinus deformity of the whole foot. In boys the equinus should be overcome by a subcutaneous lengthening of the tendo achillis and while the tendon is healing the foot should be immobilized for 6 weeks in plaster with the three bearing points in the same plane, the body weight correctly aligned and the foot dorsiflexed to 10 degrees beyond the right angle. Since this procedure alters the shape of the calf it is contra indicated for girls. Raising the heel of the shoe will compensate for the equinus.

3. Mobile pes planus due to a varus deformity of the forefoot, which is associated with an architectural defect of the longitudinal arch. This is treated by forcible manipulation under anesthesia, by which the medial border of the front part of the foot is thrust downward. The foot is then put into plaster with the heel inverted as much as possible, the forefoot everted as much as possible, and the whole foot at right angles to the leg. A rockered overshoe is fitted over the plaster and the patient is taught to walk with a natural gait, little rehabilitation being required at the end of the 6 weeks of immobilization.

4. Rigid pes planus, in which (because of the faulty transmission of weight through the subtalar midtarsal joint over a long period) the joint wears out prematurely degenerative changes set in and the range of movement dwindles on account of an inelastic sclerosis of the joint capsule. If the patient cannot be made comfortable by supporting the medial border of his foot with a rigid arch support, arthrodesis of the subtalar midtarsal joint is advisable. When the fusion is solid and the foot is released from plaster the dorsiflexion stress that necessarily accompanies the act of ordinary walking is abolished by rockering the sole of the shoe.

RUDOLPH S. KRICKE, M.D.

## SURGERY OF THE BONES, JOINTS, MUSCLES, TENDONS, ETC.

Orthopedic and Surgical Treatment of the Rheumatic Hand (Traitement orthopédique et chirurgical de la main rhumatisante) C. LASSERRE and D. PAUZAT *J. méd. Bordeaux* 1947 124: 337

Generally well known orthopedic principles are used in the treatment of hands affected with arthritis. Unfortunately patients are seen too late to make complete restoration of function possible.

It is important to evaluate which structures of the hand are affected since the treatment has to be applied to the diseased parts i.e., tendons, vessels, nerves, or the articular or periarticular tissues. The general physical status and the morale of the patient has to be taken into consideration since the treatment of the rheumatic hand often is painful and has to be administered for a long period. A thorough examination includes roentgenograms, oscilometric tests, tests for sensation to warm and cold temperatures and for range of muscle contractions hypodermic injection of histamine and adrenaline capillaroscopy, dermographism artificially produced ischemia and erythema caused by exposure to ultraviolet rays and by injections of the stellate ganglion.

The single most harmful type of treatment was found to be the immobilization of the fingers in extension, which often resulted in irreparably useless stiff fingers. The timing and indication of mobilization and immobilization are important. These were well outlined by Sterling Bunnell and named active splinting of the hand. The hand is splinted in a position of rest. The entire arm has to be included in the process of immobilization. The elbow is flexed the forearm is pronated the wrist is kept in midposition and the fingers are flexed. Splints may be used during the days when position of function of the hand is necessary and a different splint may be used at night. The splint may be made out of bivalved plaster of Paris casts duraluminum, or stainless steel. Immobilization of the fingers should be accomplished by elastic traction with the help of banjo splints.

Stenosing tenosynovitis often requires partial excision of the thickened tendon sheath. Tenotomy of contracted tendons may be helpful in restoring use of the hand in adduction deformity of the thumb.

There are a great many indications for stabilizing corrective, and arthroplastic surgical procedures. Stabilization of the thumb in a position of function by either an arthrodesis of the carpometacarpal joint or by an intermetacarpal bone graft (Thompson) is often very useful. Wedge osteotomy or simple arthrodesis of the wrist joint may be indicated in the correction of malposition of the hand.

Capsulotomies of the metacarpophalangeal joints often restore normal motion in these joints. Arthroplasty of the wrist is not a popular operation. Metacarpophalangeal arthroplasty is used when motion is limited more than 30 degrees. Arthroplasty of the interphalangeal joints has been successful in about 80 per cent of the cases.

Physical therapy and occupational therapy play an important part in the treatment of the hand afflicted with arthritis and are especially important in the postoperative treatment. GROSSER I. KRISSE, M.D.

The Paraplegia of Kyphoscoliosis (Le paraplegie da cifoscoliosi) CARLOS PAIS. *Chir. org. novim* 1947 31: 29.

The author presents his results in 8 cases of kyphoscoliosis treated by laminectomy and critically analyzes 50 cases found in the literature.



It is his opinion that paraplegia is much more frequent in congenital and in rachitic scolioses than it is in adolescent and in poliomyelitic scolioses. It is much more common in males and usually appears in the second decade of life.

Operative and autopsy observations have shown that it is not compression that produces the paraplegia but there is sufficient evidence to show that it is primarily due to traction on the cord the result of fixation of the nerve roots the increased concavity of the spinal cord and the rotation of the vertebral bodies.

The cord therefore suffers from a progressive circulatory embarrassment with resulting spinal cord softening.

The author recommends conservative management in the early cases however if no improvement is noted he believes laminectomy is necessary. In some cases he found that it was necessary to remove some of the bone of the cavity upon sectioning some of the very taut nerve roots.

The more recent work of other authors and that of the present author has shown that operative intervention is the method of choice.

The article is accompanied by an excellent bibliographic review and is well illustrated.

CARLO SCUTERI, M.D.

**Rotation Transposition Operation of the Leg (Plastic de retournement de la jambe) C. P. VAN NEE.**  
*Rev. chir. Par.* 1947 33 5 5

Disarticulation of the hip or high femoral amputation is indicated in malignant tumors of the leg. These procedures often leave a stump which is difficult to fit adequately with a prosthesis. The transposition of the tibia and fibula of the same leg into a defect of the thigh caused by the partial or total excision of the femur gives a stump similar to the one following a Gritti type of amputation. It can be satisfactorily fitted with an artificial limb.

The rotation transposition operation was first described by Sauerbruch. It is not commonly used because of its technical difficulties. In cases of complete disarticulation of the femur the entire lengths of the homolateral tibia and fibula are used to fill the defect. In partial excision of the femur only parts of the proximal tibia and fibula are transposed.

The procedure is as follows:

1. A strip of skin measuring about 3 finger breadths in width is excised along the lateral aspect of the leg, extending from the greater trochanter to the external malleolus.
2. The malignant tumor the affected femur and the affected areas of the soft tissues are excised at the required level. The resection of the femur is completed by disarticulation at the knee joint.
3. The foot is disarticulated at the ankle joint.
4. The lower leg is rotated outwardly in the frontal plane for 180 degrees into the thigh defect.
5. The lateral malleolus is placed into the acetabulum (in disarticulation of the hip only). The medial malleolus serves as a greater trochanter.

6. The muscles of the thigh are sutured to the muscles of the lower leg.

7. The skin edges are sutured.

A similar technique is followed in cases in which only a portion of the proximal tibia and fibula are used to replace the defect caused by partial resection of the femur. The transposed tibia is attached to the proximal femoral stump by a bone graft.

The patella is attached to the distal end of the stump i.e., the upside-down reversal of the proximal end of the tibia. The vessels and nerves form an arc at the popliteal fossa which does not impair their function. Sensation is preserved although it is distorted.

A partial rotation transposition operation was done on the left leg of a 33 year old nurse. Partial resection of the distal two-thirds of the femur was necessary because of a myxochondrosarcoma. A complete rotation transposition operation was done on the right leg of a 21 year-old male. Disarticulation of the femur at the hip joint was indicated because of a Ewing's sarcoma. In both, wound healing occurred per primam, and the nurse tolerated a prosthesis very well which made it possible for her to return to work. She was followed up for about 3 years postoperatively. The young man will soon be fitted with a prosthesis. GREGG L. REISE, M.D.

## FRACTURES AND DISLOCATIONS

**Anatomopathologic Basis and Treatment of Habitual Dislocation of Shoulder (II fondamento anatomico patologico e la cura della lussazione abituale di spalla) FRANCESCO DRITALA. *Chir. org. modim.*, 1947 3 199.**

The real cause of habitual dislocation of the shoulder is a disengagement of the capsule or glenoid labrum from the osseous margin of the glenoid cavity. It follows that the causative therapy consists of the union of both structures. The author published his method of attaching the capsule or the glenoid labrum to the margin of the bone by metal staples in 1943 and claims priority because Downing and also Myers described an identical operation in 1946. The operation is based on Bankart's concept of habitual dislocation of the shoulder.

The operation can be performed under local anesthesia. The patient is placed in a supine position with the involved arm abducted. The articulation is exposed through an 8 cm. long incision along the deltopectoral sulcus. Capsulorrhaphy is accomplished by the insertion of 2 nonoxidizable T-shaped staples through the capsule and the scapular margin. Silk, catgut or metal that may become oxidized are not suitable for this purpose. The soft tissues are closed with catgut and a plaster of Paris cast is applied with the arm in adduction and in the anterior position. The immobilization is maintained for one month and after that heat massage and active motions are employed.

The author performed the operation in 30 cases with good results. JOSEPH K. NARA, M.D.

**Indications and Technique in the Treatment of Fractures of the Humerus with Paralysis of the Radial Nerve** (Indicazioni e tecnica nella cura delle fratture dell'omero con paralisi del nervo radiale).  
LEONARDO GUL. *Chir. org. movim.* 1947 31 107

The author reports on 14 patients who had sustained compound fractures of the humerus with non union and radial nerve paralysis. The article is well illustrated with preoperative films and post operative films some after a lapse of several years. Also there are photographs of the patients showing the end results. These patients were operated upon by Scaglietti at the Centro Orthopedico e Mutilati in Bologna, Italy.

The procedure used was shortening of the humerus until the ends of the nerve could be brought together then holding of the freshened bone ends together with kangaroo tendon.

The results in 10 cases of complete radial nerve severance with radial nerve suture were complete return of function in 6 cases partial return in 3 and no return in 1. Liberation of the radial nerve was done in 2 cases with complete return of function. Repair of a severed musculocutaneous nerve was done in 1 case with complete return. Repair of the severed ulnar and median nerves was done in 1 case with uncertain results up to the time the article was published.

Periarticular fibrosis with some loss of shoulder and elbow motion was noted in a number of cases while an almost normal range of motion of all the joints was obtained in the other cases. No report was made of residual pseudarthrosis in any of the cases of fracture of the humerus. CARLO SCUDERI, M.D.

**Final Results of Osteosynthesis of Fractures of the Femoral Neck** Ad Medium Sven Johansson. A Study of a 16-Year Material. *Gycknar. Ontk.* 1947 96 Supp 131

Internal fixation of fractures of the femoral neck by means of wood screws was used by Langenbeck in 1858 for the first time. In 1897 Nicolaysen described the technique of inserting a screw through the femoral neck immobilizing the patient in a plaster cast for 4 weeks and then removing the screw after 4 weeks had elapsed. It was not until 1925, when Smith Petersen introduced the three flanged nail, that internal fixation of fractures of the femoral neck became a method of choice in the hands of the skilled surgeon. Sven Johansson made the extensive dissection recommended by Smith Petersen unnecessary by using a guide wire and a cannulated nail. Waldenstrom called attention to the fact that the valgus type of fracture of the femoral neck healed much better than the varus type. Gammelgaard suggested that surgical intervention in the valgus type of fracture (abduction type) was unnecessary. Pauwels divided the fractures of the femoral neck into three groups: those in which the angle of the fracture line was between 0 and 30 degrees; those in which it was between 30 and 50 degrees; and those in which it was between 50 and 80

degrees and he outlined the type of treatment for each group.

A group of 314 patients with fracture of the upper end of the femur were operated upon by the author 79 per cent of whom had the varus type of fracture 14 per cent the valgus type 57 per cent the intertrochanteric, and 13 per cent the peritrochanteric. The mortality in Denmark was 15 per cent before introduction of the internal fixation of femoral neck fractures and 17 per cent after nail fixation was generally accepted.

All patients with fractures of the femoral neck were operated upon except those with the definite valgus type of fractures. Traction was applied for one week prior to the operation and particular importance was paid to leaving the leg in an externally rotated position because in this position disengagement of the fragments occurred and final reduction at the time of operation was made much easier. Immediately prior to the actual nailing procedure the leg was internally rotated until the patella pointed 25 degrees medially. In cases in which good alignment of the fragments could not be obtained in spite of traction and preoperative maneuvers the operation was cancelled and the patients were returned to the ward and additional traction was applied. Spinal anesthesia was found satisfactory in most cases. The guide wire was inserted by manual guidance and the nail inserted after the position of the guide wire was found to be satisfactory on a roentgenogram. The patients were kept in bed for 4 weeks postoperatively and physical therapy was started one week after the operation. Approximately every fifth patient showed some change of the position of the fragments postoperatively. The femoral head was allowed to rotate posteriorly to some degree but too much retroversion caused anterior displacement of the fragments and an anterior position of the nail which factors contribute to the postoperative slipping of the nail. It was found to be better to keep the nail in a more posterior position at the time of nailing.

Technical errors at the time of surgery were found to be the predominant factors in the postoperative slipping of the femoral head i.e. inadequate reduction unsatisfactory position of the nail or an unsuitable length of the nail. Another less frequently found cause was slipping or breaking of the nail. Changes in the femoral head itself caused the head to change its position postoperatively in a large percentage of cases. Schmorl stated that use of the leg favors callus formation. Too much motion of the leg was a frequent cause of nonunion of fractures of the femoral neck. Age early ambulation and the patient's weight had no bearing on postoperative slipping of the head.

In the group of 314 cases 66 patients showed post operative slipping of the head. Only 38 were reoperated upon. Of these, 16 had aseptic necrosis of the head 13 had aseptic necrosis of the femoral neck and 15, traumatic arthritis. At the time of the second operation a favorable position of the fragments was

unobtainable as a rule, and the nail slipped out postoperatively in every case.

Most workers suggest an osteotomy as the procedure of choice in cases in which aseptic necrosis of the femoral neck or head followed the primary surgical procedure. In cases in which the head and neck showed no destruction in spite of nonunion, renailling or nailing and bone graft have been recommended.

Evaluation of the final results was complicated by the fact that a number of the patients, most of them 60 years old or older, died or became bedridden because of cerebral accidents. Healing of the femoral fractures was characterized on the roentgenograms by bridging bone across the fracture site. Lack of full motion in the hip was not as disabling as pain. Age had no influence on the final outcome. Aseptic necrosis of the femoral head was found in 38 per cent of all patients treated by internal nail fixation. The first sign appeared on the roentgenogram within 3 to 5 months postoperatively. It took from 1 1/2 to 3 years for the repair of the femoral head by creeping substitution. A large number of the patients showing aseptic necrosis of the femoral head had at one time or another dislocation of the head, i.e., either at the time of injury or at the time of manipulation or internal nail fixation. Corrosion or breaking of the nail or age of the patient had no influence on the occurrence of aseptic necrosis of the femoral head. Pain is the predominating complaint in aseptic necrosis of the femoral head.

Resorption of the femoral neck was due either to squashing of the neck at the time of injury, especially its posterior aspect, or to instability at the fracture

site following surgical intervention. Sixty-nine per cent of all unstable nail fixations showed resorption of the femoral neck.

The outward slipping of the nail was found to be due to inadequate insertion and resorptive processes in the femoral neck. Extrusion of the nail occurred in 78 per cent of all renailings and in 29 per cent of primary nailings of femoral neck fractures.

It was found that Swedish steel or chromium-nickel steel had greater noncorrosive properties than vitallium.

GEORGE F. REIM, M.D.

## ORTHOPEDICS IN GENERAL

### Restoration of the Thumb. ARTHUR J. BARKER.

*Surgery* 1948, 23, 227

The losses of the thumb are divided into partial losses in which no more than the distal phalanx is lost, subtotal losses, involving approximately both phalanges of the thumb, and total losses meaning that not only are both phalanges missing, but that all or most of the metacarpal of the thumb is also absent.

The author describes a successful technique for restoring the thumb by means of a finger transplantation and nerve suture. The use of different types of pedicled skin grafts, bone grafts, and substitution toe grafts is described. A simple practical work prosthesis is described and shown. Phalangization of the thumb metacarpal is often very helpful in aiding the prehensile function of the thumb. The details of the armamentarium and surgical technique are completely described.

DANIEL H. LEVINTHAL, M.D.

# SURGERY OF THE BLOOD AND LYMPH SYSTEMS

## BLOOD VESSELS

**Operative Exposure of the Blood Vessels in the Superior Anterior Mediastinum** HARRIS B. SHU  
MACKER, JR. *Ann Surg* 1948, 127, 464.

The author believes that each operative exposure of the superior anterior mediastinum must be individualized but insists that all exposures must be ample if one is to carry out a procedure which offers safety to the patient. In any contemplated excision of an aneurysm or arteriovenous fistula, it is essential to isolate the vessels both proximal and distal to the lesion before attacking the lesion itself.

An incision is made from the midportion of the clavicle down over the sternoclavicular joint and continues down the midline of the sternum to the level of the third or fourth interspace. The inner third of the clavicle is excised and the sternum is split longitudinally down to the second or third interspace. The edges of the sternum are retracted with bone hooks until the underlying structures are freed with blunt dissection, and then a small rib spreader is substituted. This gives an adequate exposure of the innominate veins superior vena cava, arch of the aorta, innominate artery subclavian artery carotid artery and phrenic and vagus nerves.

After the vascular surgery is completed the wound is closed in layers. The sternum is re-approximated either with wire or silk sutures. The clavicular perosteal bed is carefully closed with interrupted silk sutures. In some cases the excised portion of clavicle has been replaced in the form of bone chips. The overlying muscles, fascia, and skin are closed with silk.

DANIEL ROOZ, M.D.

**Disasters following the Operation of Ligation and Retrograde Injection of Varicose Veins.** JOSE  
PHILIP C. LUKE and G. GAVIN MILLER. *Ann Surg.*  
1948, 127, 426.

The authors cite 21 illustrative cases representative of untoward reactions which infrequently occur following ligation and retrograde injection of the saphenous vein for treatment of varicosities. These complications are divided into those resulting from deep venous thrombosis and those due to operative difficulties and errors.

The formation of thromboses constitutes the larger group of complications caused probably by two factors: reduced muscular activity postoperatively with consequent slowing of the venous return and injection of too large a quantity of sclerosing fluid.

Operative errors include clamping of the femoral vein severe hemorrhage injection of sclerosing material into the wrong vessel and occlusion of major arterial trunks by spasm and thrombosis, causing gangrene of the entire leg or a particular area.

Both types of complications can result in disability of varying degree and fatality. The following sug-

gestions are advocated to reduce the morbidity of this operative procedure (1) a local anesthetic only should be used and the patient should walk immediately following operation (2) no more than 5 c.c. of sclerosing solution should be injected.

C. FREDERICK KITTLE, M.D.

**Some Observations on the Early Management of Gunshot Wounds of the Arteries** DOUGLAS  
LESLIE. *Austral N Zealand J Surg* 1948 17, 163.

The observations on which the present article is based were made by the author during his experience (9 months) with forward surgical teams in New Guinea and in the Dutch East Indies, and during a further period of 24 months with advanced general hospitals in the same areas. The author classifies the pathology of arterial injury in the following.

**The "near miss"** After a high velocity projectile has passed close to an artery the vessel may sometimes be seen to be in spasm without having any visible organic damage in its walls.

**The contused artery** The contused vessel when exposed, is seen to have a patch of bruising in its wall. The intima may be partly ruptured and there may or may not be a thrombus present in the lumen. There is nearly always some arterial spasm present. There is no primary bleeding from the injured vessel but if the wound becomes septic, secondary hemorrhage is probable. Also traumatic false aneurysm may follow such an injury.

**The partially divided artery** In the partially divided vessel there is a lateral opening involving a certain fraction of its circumference.

**The severed artery** A completely severed artery often stops bleeding spontaneously even if it is as large as the axillary or common femoral artery.

**The ischemic limb** Some limbs survive only to require later amputation because of ischemic contracture which renders them painful and useless. An ischemic limb is particularly susceptible to all types of infections, of which the most important are those by anaerobic organisms.

The objects of treatment are (a) to save the patient's life (b) to save his limb (c) to prevent as far as possible the later complications—sepsis secondary hemorrhage traumatic false aneurysm arteriovenous communication and ischemic contracture.

In instances in which there is a relatively small external wound near the course of a large vessel with signs of impairment of the distal circulation in that limb such impaired circulation is due either to a complete lesion, or if the lesion is incomplete to the presence of intravascular clot, pressure or periarterial subfascial hematoma or collateral spasm. The complete lesion calls for ligation above and below and for evacuation of the surrounding clot so as to decompress the fascial compartment and its valuable muscular collaterals. The incomplete lesion also

calls for ligation and decompression (only this can relieve pressure on the collaterals) and this also will help to relieve collateral spasm and enable the collateral circulation to expand. This procedure will also reduce the incidence of the late complications—traumatic false aneurysm secondary hemorrhage and arteriovenous communication all of which carry with them an appreciable limb mortality. In cases in which a small external wound is seen near a large vessel, but the distal circulation is normal the decision whether to operate or not is made purely on the characteristics of the wound itself and if this is minute and there is no evidence of tension beneath the deep fascia, operation need not be considered. In some of these cases the late complication of arteriovenous communication occurs and therefore any artery that might pass near a wound track should be examined with a stethoscope. If an intact vessel is seen traversing an infected wound the arteries should be tied when the abscess is drained.

#### THE PROBLEMS OF THE SMALLER VESSELS AT SPECIAL SITES

**The Ight calf.** A gunshot wound through the posterior fascial compartments of the leg is often associated with subfascial bleeding from the posterior tibial artery. One of its branches the hematoma infiltrates the muscles widely and produces considerable swelling of the leg. Such a calf is an ideal site for the occurrence of aerobic infection and there is also sometimes impairment of the circulation in the foot.

**The bleeding hand.** A hematoma in the hand requires decompression just as does one in the thigh apart from the possibility of infection, a hematoma beneath the palmar fascia can cause serious interference with the circulation in the fingers. By properly placed incisions it is better to attack the bleeding point than to trust to proximal ligation.

**The bleeding buttock.** A local exposure must be made a much draw the dangerous gluteal muscle mass as in the hope of finding the bleeding point. It may be necessary to put a temporary pack in the opened buttock and then to obtain hemostasis by ligation of the internal iliac artery. Makins in writing of secondary hemorrhage cites ligation of the internal iliac artery for bleeding buttock as the only justifiable example of proximal ligation for hemorrhage at a distance. It may also be required for primary hemorrhage at this site. The main trunk of the vessel must be tied rather than one of its divisions, as is often cannot tell whether the bleeding is from the superior gluteal (posterior division) the inferior gluteal (anterior division) muscle.

C. FRED GOERING, M.D.

**The Problem of Maintaining the Continuity of the Artery in the Surgery of Aneurysms and Arteriovenous Fistulas.** HARRIS B. SHUMACKER, J.  
*A. Surg.* 9:18 27 207

The author reports his experience with the surgical treatment of aneurysms and arteriovenous fis-

tulas (about 300 cases). The report deals specifically with 34 cases in which some type of reparative procedure was accomplished. Early in the author's experience he cared for 138 patients with involvement of the innominate, common and extracranial portion of the internal carotid, subclavian axillary brachial iliac, common femoral femoral, and popliteal arteries, in which continuity of the blood supply is desirable. Repair was performed in only 4 (2.9%) of these. He then determined to carry out a repair in every instance in which this could possibly be performed without sacrificing the collateral arteries and without leaving in situ obviously badly damaged portions of arteries. This resulted in the repair of arteries in 30 of the last 57 cases (52.6%). Four types of repair were carried out: (1) ligation or transfixion of the fistula, (2) lateral arterioorrhaphy, (3) end-to-end suture and (4) vein transplantation. The principle of everting mattress sutures of either fine silk or cotton was employed. Anticoagulants were used in most instances of lateral suture, end-to-end suture and vein graft. In some cases sympathectomy was employed as an aid to circulation.

Thirteen patients with arteriovenous fistula were treated by ligation and transfixion of the fistula with maintenance of the continuity of the artery. The ages of the patients varied from 19 to 45 years, and the duration of the fistulas was from 4 to 11 months. The fistula was between the carotid artery and jugular vein in 3 instances, between the popliteal vessels in 4, the femoral in 5 and the axillary in 1 case. In 8 cases sympathectomy was performed because of poor collateral circulation. Anticoagulants were used in 3 cases. The size of the fistula varied from 3 to 11 mm. in diameter. In 6 cases sacular aneurysms were present. These arose from the vein in 3 cases, from the fistula in 2 and from the artery in 1 case. In one patient in whom simple transfixion of the fistula was performed recurrence of the bruit and thrill was evident 2 days after operation. The fistula was excised with quadruple ligation 2 weeks later with good results. The results in all cases were excellent.

In 5 cases the arterial defect was repaired by lateral suture. In 2 of these the defect was a traumatic arterial aneurysm, and in 3 an arteriovenous fistula. The brachial artery was affected in 1 case the subclavian artery in 2 cases and the femoral artery in 2. The arterial defect were from 3 mm. to 13 mm. in length. Two patients received anticoagulant therapy. One patient with a sacular aneurysm of the brachial artery developed a hemorrhage on the thirtieth postoperative day the artery being bathed in a pool of pus. This was excised and the result was satisfactory. One patient with arteriovenous aneurysm of the middle third of the femoral artery a thrombosis developed 3 hours after operation following excision of the thrombosed vessel the result was good. This occurred presumably because of the extent of damage to the artery and the narrowing of its lumen after closure of the defect. The rest achieved satisfactory results.

In 10 cases the artery was repaired by end to-end suture. The ages of the patients ranged from 19 to 35 years and the lesions varied in duration from 3 to 85 months. Eight of these patients had an arterial sacular aneurysm and 2 had an arteriovenous fistula. The lesion involved the brachial artery in 7 cases, the axillary artery in 2 and in 1 patient a double fistula was present between the femoral and the profunda femoral arteries and femoral vein. In one patient sympathectomy had been performed before operation. It was necessary to excise segments of artery ranging from 1.5 to 3 cm. in length. In lesions of the axillary and brachial vessels length of artery was gained by adducting the arm to the body and flexing the forearm. This position was maintained postoperatively. In one case in which the fistula involved both the femoral profunda and the arteries the divided ends of the femoral artery could not be approximated. It was, however, possible to approximate without tension the proximal end of the profunda to the distal stump of the femoral artery.

The patients were followed for a period of from 1 to 5 months and in 8 patients the result was successful as regards the patency of the artery.

In 6 cases the arterial defect (aneurysm in 3 and arteriovenous fistula in 3) was repaired by vein transplantation. The patients ranged in age from 19 to 36 years. The brachial artery was involved in 1 patient, the popliteal artery in 1 and the femoral artery in 4 patients. Sympathectomy had been performed in 2 cases. The sources of vein grafts were the saphenous and femoral veins. All patients were given anticoagulants. Patency was maintained in all but one case.

The reparative procedures were, therefore successful in 28 of 34 cases. The failures were evidenced by recurrence of fistula and thrombosis of repaired segments. Postoperative hematomas developed in 4 patients all of whom were receiving anticoagulants. Patency was determined by clinical examination, arteriography and oscillometric studies. One unexpected finding was that in general oscillations were about equal in the extremities operated upon and normal in those cases in which a fistula was simply ligated and transfixed, slightly reduced in lateral arteriorrhaphy and reduced to a somewhat greater degree in cases of end to-end suture or vein grafting. The cause of this is unexplained. In any event there was little or no evidence of any functional circulatory impairment. In general, the functional results of operative repair were found to be excellent.

The author believes that in addition to the usual considerations of arterial repair, 4 mattress sutures placed equidistant are better than 3 in end to-end anastomosis, and that everting interrupted mattress sutures are best for the repair. He is inclined to favor suture methods rather than mechanical aid in arterial repair. The author's experience with the nonsuture methods has not been very satisfactory.

LEROY J. KLEINWASSEL, M.D.

#### Complete Transposition of the Aorta and the Pulmonary Artery C. ROLLINS HAMILTON and ALFRED BLALOCK. *Ann. Surg.* 1948, 127 385

The authors point out that in complete uncorrected transposition of the great vessels the aorta arises from the ventricle receiving systemic venous blood and the pulmonary artery arises from the ventricle receiving oxygenated blood—a condition in compatible with continued existence. In most instances, however, some communication exists between the two circuits through an interventricular or interatrial septal defect, patent ductus arteriosus, or by the passage of pulmonary venous blood into either vena cava thus permitting the patient to survive for variable periods, an average duration being 19 months for all the associated abnormalities. An interventricular septal defect plus a patent interatrial septal defect gives the best prognosis; an interatrial septal defect alone provides the next longest life expectancy and a patent interatrial defect alone the third most favorable life expectancy.

The authors have endeavored to develop a surgical method of treatment of complete transposition by effecting the return of the blood of the pulmonary vein into the vena cava or the right auricle as such a condition has been occasionally detected as an isolated abnormality at operation or autopsy in patients who have shown no evidence of cardiovascular difficulty and has been described as a beneficial adjustment in transposition. These studies demonstrate the feasibility of anastomoses of the veins from the two upper lobes of the right lung to the superior vena cava, whereas the anastomoses to the right auricle tended to become occluded. Catheterization of the heart chambers and superior vena cava established the effectiveness of this shunt in returning blood to the right side. Thus far the authors have been unable to prepare an animal with complete transposition so the effectiveness of such a shunt actually in this state has not been established but this method may offer a possible approach to the surgical treatment of complete transposition of the great cardiac arteries in man.

EDWARD H. CAMP, M.D.

#### BLOOD TRANSFUSION

##### Normal Red-Cell Survival in Men and Women SHEILA T. CALLENDER, E. O. POWELL, and L. J. WITTS. *J. Path. Bact.* Lond. 1947 59 519

The authors present the results of their studies concerning the survival of transfused erythrocytes by the method of differential agglutination in 4 normal females and 2 normal male subjects of group A from whom blood was removed and replaced by blood of group O.

The curve of decay of the transfused cells was linear in men and appreciably curved in women. The average lives of the cells were 63 and 54 days respectively.

The relation has been deduced between the decay of transfused cells and the law of survival of the in

dividual erythrocyte on the assumption that two types of destructive factor are normally operative.

It is concluded that most red cells live for approximately the same time 120 days in both men and women.

Extraneous factors cause the loss of some cells before they have reached this age limit. The loss is greater in women than in men by the equivalent of 400 c.c. of blood per month—more than can be ascribed to menstruation.

The average age of cells at death is tentatively assessed at 90 to 100 days in women and 110 to 120 days in men. LEROY J. KLEIDMANER, M.D.

**The Causes of the Delay in Coagulation in Hemophilia; Role of the Platelets** (Sur les causes du retard de la coagulation chez l'hémophile. Rôl des plaquettes) M. BOURSTIN. *Rev. hemet* 1947 2 498.

In summarizing work previously reported by other investigators, the author starts with the assumption that the delay in coagulation in hemophilia is due to a lack of some factor rather than the presence of an inhibitory substance. The blood fibrinogen seems to be qualitatively and quantitatively normal. There is no lack of calcium ion and the prothrombin level is apparently normal. There seems to be a disturbance in thromboplastin but it has not been previously determined whether this is due to a defect in the platelets or in some noncellular constituent of the plasma.

Four patients with hemophilia were studied to determine the role of the platelets and the origin of the antihemophilic factor. Two plasma fractions were prepared from citrated blood, one with a high platelet

count, and the other essentially free of platelets. These fractions were recalcified and the coagulation time was measured. When normal plasma was used, there was little difference in the clotting time between the platelet rich and platelet-free fractions. With hemophilic plasmas the coagulation time was two or three times as long if the platelet-free as for the platelet rich fraction. Heparinized normal plasma gave results similar to those of hemophilic plasma.

When the platelets were broken down by agitating the platelet rich plasma with powdered glass the coagulation time of both normal and hemophilic plasma was reduced. However, the clotting time of the hemophilic plasma was still considerably more prolonged than that of normal plasma. Heparinized normal plasma exhibited similar behavior to hemophilic plasma when the platelets were fragmented.

From these observations the author concluded that the coagulation time of normal plasma is almost independent of the level of platelet thromboplastin. However the platelet thromboplastin of hemophilic plasma caused a marked acceleration of the clotting time of platelet free normal plasma. The platelet thromboplastin of normal plasma had a less marked effect. Apparently the plasma in hemophilia lacks some factor and in the absence of this factor the platelet thromboplastin is less active, even when it is in excess. This antihemophilic factor seems to be necessarily of nonplatelet origin. The appearance of active thromboplastin requires the joint action of a plasma factor and a platelet factor.

THEODORE B. MARSHALL, M.D.

# SURGICAL TECHNIQUE

## OPERATIVE SURGERY AND TECHNIQUE POSTOPERATIVE TREATMENT

**The Risk of Surgery in Heart Disease.** DONALD R. MORRISON *Surgery* 1948, 23 561

The author made a study of 150 patients who had been subjected to 189 operations. All cases in this series answered the requirements of the American Heart Association for inclusion in the group of cases of rheumatic heart disease (1) a history of any of the manifestations of rheumatic fever (polyarthritis, chorea, muscle or joint pains, subcutaneous nodules) and (2) evidence of a characteristic structural lesion of the heart (carditis, cardiac valvular disease, adherent pericardium).

For inclusion in the group with arteriosclerotic heart disease it was required that the patient present signs or symptoms of cardiac abnormality—enlarged heart, a previous episode of failure, previous coronary occlusion, anginal attacks, abnormal dyspnea, orthopnea, etc.—without a history of rheumatic fever, syphilis, or thyroid disease, and supported by at least one characteristic clinical finding such as cardiac enlargement shown by roentgen examination, electrocardiographic changes, or congestive heart failure. Postmortem evidence of coronary sclerosis, and definite electrocardiographic findings such as inverted T waves, diphasic T waves, or auricular fibrillation or flutter and heart block in the absence of other etiologic possibilities, have been accepted as proof of the disease without the requirement of any symptoms. Patients with symptoms of heart disease and no other more specific findings of cardiac arteriosclerosis were not included.

Three hundred and eleven patients were found to answer these requirements and they were subjected to 485 operations.

### SYPHILITIC HEART DISEASE

Seventeen patients had 27 operations. Of these, all except a 4 plus Wassermann reaction and a widened aorta confirmed by roentgen examination. This study made possible the following conclusions:

1. The risk of surgery in rheumatic heart disease is not great. What risks there are seem to center in certain types of patients with rheumatic heart disease, namely those over 35 years of age, those with fibrillations, and those with a high functional classification. No relationship to risk could be demonstrated for operating time or the combined presence of aortic and mitral lesions.

2. The risk of surgery in arteriosclerotic heart disease is considerably greater and seems to be centered in the etiologic diagnosis. It does not appear to be significantly modified by the various anatomic, physiologic, or functional factors except that disorders of cardiac rhythm and poor renal function produced higher risk rates. Patients with arterio-

sclerotic heart disease showed a mortality rate four times that of rheumatic heart disease.

3. The risk of surgery in syphilitic heart disease cannot be accurately determined in the small number of cases available. However the evidence suggests that the risk is less than in arteriosclerotic heart disease but it is greater than in rheumatic heart disease.

4. No single anesthetic agent is definitely superior for patients with heart disease, however it seems that local anesthesia should be used if feasible and spinal anesthesia avoided if possible.

C. FRED GOERDMAN, M.D.

## ANTISEPTIC SURGERY; TREATMENT OF WOUNDS AND INFECTIONS

**The Treatment of Local Pyogenic Infections with Anticoagulants (Heparin).** PH. SANDSLOW, G. E. STRÖM and O. QUIST *Acta chir. scand.*, 1948, 96 323.

Twenty four patients with local pyogenic inflammatory processes were treated with heparin on the assumption that the infection-combating powers would have better access to the foci of disease when the thrombus formation in the small vessels and the deposition of the fibrin in the tissues had lessened. One-half of the patients, especially those with infection of a diffuse, phlegmonous character, had an unusually favorable course in connection with the heparin treatment. JOHN J. MALONEY, M.D.

### ANESTHESIA

**The Local Anesthetic Properties of Amidone (Dolophine).** FRANK G. EVERETT *Anesthesiology* 1948, 9 115.

Considerable structural similarity exists between meperidine (demerol) and amidone. On this basis one would expect that these compounds would have similar pharmacological properties. This has been demonstrated with respect to analgesia, spasmolysis on isolated intestines and certain parasympathetic actions.

The author reports his observations on the local anesthetic action of cocaine, meperidine and amidone. He compared the action of these compounds by (1) noting their anesthetic effect on the cornea of the rabbit, and (2) observing their effect on the human intradermal wheal.

Amidone was found to possess strong local anesthetic effects in the concentrations used, 1% and 5% per cent solutions of the hydrochloride salts of the agents tested were used for anesthesia of the rabbit's cornea, and 0.25 per cent solutions of the hydrochlorides of the three agents were used for the human intradermal wheal anesthesia. Amidone produced a duration of anesthesia of the rabbit's cornea approximately equal to that with cocaine, while the dura-



# INTERNATIONAL ABSTRACTS OF SURGERY

of anesthesia for the human intradermal wheal is slightly longer with amildone.  
Meperidine in comparison with cocaine and amildone, produced incomplete anesthesia of the rabbit's nose and a much shorter duration of anesthesia in human skin.  
The irritant properties of both amildone and meperidine precludes their practical use at present as local anesthetics.

MARY KEAR M.D.

**Chondrocurare in Inhalation Anesthesia** (O  
kondrocurare na anestesia por inalacao) Ugo  
PIMENTA GUERARDES, AURELIO PAVRY E SOUZA,  
and OSWALDO VITAL BRAZI Rio de Janeiro, 1948,  
17 p.

A product called chondrocurare which is dimethyl-ether-hydrochloride of methylthelocaine, was found useful by the author as an adjuvant in inhalation anesthesia. The drug is given intravenously in the form of a 3,000 solution in normal saline solution. In exceptional cases intramuscular injections may be given. Apparently the rate of injection is of no clinical importance. As a rule the drug is injected at the same speed as intocostin.

Muscular relaxation is obtained within from 30 to 60 seconds after the intravenous administration of chondrocurare, and within 15 minutes when the intramuscular route is employed. Experiments on mice showed intocostin to be more effective than chondrocurare, but in man equal volume doses of both substances have an identical effect. The effect of one unit of curare or of 1 mgm. of chondrocurare corresponds to that of 0.5 mgm. of chondrocurare. The drug is obtained from the plant chondrodendron platyphyllum tomentosum. The first men-

tioned plant grows in Brazil.  
The author employed the drug in several doses of cyclopropane ether and oxygen, or nitrous oxide and oxygen. A satisfactory relaxation was obtained in 58 per cent, and an excellent one in 42 per cent of the cases. No untoward effects were observed by the author. The effect of chondrocurare on the blood pressure, pulse, and respiratory movements is identical to that of curare proper.

JOSEPH K. NARAT M.D.

cessive secretions. Open drop administration of either still remains the anesthetic method of choice in children. For the geriatric patient the dose of morphine should be greatly reduced or omitted completely and demerol (from 50 to 75 mgm.) or a barbiturate should be given in conjunction with atropine. Local and regional blocks are the choice of the author in minor procedures. Hypoxia should be avoided.

Coexisting pathology which increases the surgical risk may determine the selection of the anesthetic agent and technique. Conditions such as diabetes and anemia should be controlled prior to extensive orthopedic procedures. In patients with heart disease and some evidence of loss of compensatory mechanisms, local or regional block anesthesia should be used whenever possible. If the pulse rate becomes markedly irregular from 30 to 70 mgm. of procaine should be injected into the veins immediately to diminish the irritability of the conducting mechanism of the heart and revert the disturbed rhythm to a regular sinus rhythm. In a patient with moderately severe diabetes who is under control an infusion of 1,000 c.c. of 5 per cent glucose is usually given 4 hours preoperatively or during the operation. Care must be used to distinguish between the shock of operation and insulin shock.

The type and site of certain orthopedic procedures add to the anesthetic problems and call for increased vigilance and better methods of control. Before spinal fusions the patient should be intubated, and controlled respiration should be employed for the greater part of the operation to augment the exchange of gases. For closed reduction and internal fixation of the neck of the femur a weak sodium hyalinal drop solution (from 0.1 to 0.2%) in 5 per cent glucose and distilled water is used with a 5 per cent gas-oxygen mixture.

Traumatic and hemorrhagic shock should be controlled early and blood loss should be replaced as it occurs.

# PHYSICOCHEMICAL METHODS IN SURGERY

## ROENTGENOLOGY

**The Geometric Problem of Stratigraphy (Il problema geometrico della stratigrafia)** ALDO PERUSSA.  
*Radiol. med. Milano 1948 34 1*

The author furnishes a preliminary report of an extensive research carried out in collaboration with a mathematician and pertaining to the geometric problems of stratigraphy.

To allow a comparative study of various modalities of stratigraphy it is essential to consider the geometric data. Stratigraphy can be accomplished only if a certain law regulating the reciprocal relations between the focus and the film is observed. Theoretically an infinite number of solutions complying with this law is conceivable each being determined by the degree of the displacement of the focus.

The author discusses the characteristics of a single concrete modality of stratigraphy. Each modality is a complex function of the displacement of the focus and is related to the shape and thickness of the layer traversed by the x rays.

The author discusses the possibility of an exact geometric and numerical expression of various modalities of stratigraphy. Such mathematical definition of the various modalities is based essentially on the study of surfaces presenting an equal degree of vanishing of shadows.

ARTHUR F. CIPOLLA, M.D.

**Radiographic Anatomy of the Normal Thymus with Pneumomediastinum (Saggio di anatomia radiografica del timo normale col pneumomediastino)**  
GOFREDO GIANCARDI. *Radiol. med., Milano 1948, 34 27*

The author studied the normal anatomy of the thymus by comparing his findings obtained with an anterior pneumomediastinum followed by roentgenography with those found at autopsy. Eleven cadavers were used, the patients varying from a few days to 84 years of age but having no clinical symptoms of thymus involvement.

With the cadaver in the horizontal position roentgenograms were taken in two projections. A pneumomediastinum was done by the technique of Condorelli and this was followed by a repetition of the roentgenography.

Finally an autopsy was done, the condition not only of the thymus and its compartment being ascertained but also that of the mediastinum and lungs.

The comparison of the roentgenograms with the anatomy of the thymus found at autopsy showed no exact similarity. An opaque band was seen on the lateral projected roentgenogram which was produced either by the thymus or by retrosternal deposits of fat.

ARTHUR F. CIPOLLA, M.D.

**Accumulation of Blood Simulating Primary Bronchial Cancer** JOHN D. CALL and PORTER P. VAN SOY. *Am. J. Roentg., 1948, 59 127*

An area of increased density in a chest film is usually interpreted as being due to a tumor in inflammation. Rarely is an increased density in chest roentgenograms due to an accumulation of blood.

In the case reported the patient coughed up a considerable amount of blood. Chest films revealed a density in the right base which was interpreted as being due to a tumor. Bronchoscopy revealed a simple bronchial erosion which was treated by curettage dilatation and the administration of neosynephrin. Follow-up chest films, 7 months later failed to reveal any evidence of pathology.

MAURICE D. SACHS, M.D.

**Variations of the Diaphragmatic Contour Their Cause and the Diseases Which They Simulate (Variaciones del contorno diafragmatico. Su genesis y enfermedades que simulan)** M. CERQUIGRA GOMES. *Rev. esp. enferm. digest. 1948, 7 1*

The author presents a detailed and extensive discussion of the literature concerning the variations of the diaphragmatic contour apropos of a case diagnosed as hydatid cyst of the hepatic convexity. He discusses the functional exploration of the diaphragm its physiologic and physiopathologic variations, and suggests interesting conclusions. He calls attention to the scarcity of literature with regard to this problem even in roentgenologic journals and texts.

The variations of diaphragmatic contour may be due either to supradiaphragmatic, diaphragmatic, or infradiaphragmatic processes.

The survey of the diaphragm should include fluoroscopy and roentgenograms in anteroposterior oblique and lateral positions in deep inspiration and in expiration as well as transverse roentgenograms in anteroposterior and lateral projections. The lateral position is recommended especially. In some instances it will be necessary to produce a pneumoperitoneum to rule out any hepatic process.

The theories of Minkowsky, Testut and Plesch about the physiology of the diaphragm are discussed but are not accepted. Instead the following conception is proposed: the diaphragm is constituted of two different muscular groups, a posterolateral which pulls the diaphragm downward and an anteromedial which helps to raise the sternum and the seventh and eighth ribs, the two actions succeeding each other immediately, first the posterolateral segments contract and pull the central tendon downward and then with the fixed point in the central tendon immobilized by the abdominal pressure the anteromedial segment lifts the chest wall.

The classic contour of the right hemidiaphragm may show two main variants: a type of division in two arcs with different levels (the most frequent one)

and a type of digitation (which is rarer) which is seen only on the left side.

These variations were explained by Thomas and Assman, Singer, and Boikan and Pendergram and Hodas as physiologic ones due to the difference in the energy of the two muscular groups of the diaphragm, but it was always considered that both groups pull the organ downward. The author disagrees and explains his new conception of the physiology of the diaphragm.

The author states that the division into arcs of the diaphragm the contour has been found in 7 per cent of the roentgenograms of chests in adults, but he does not indicate upon how many observations his conclusion is based. **EDWARD P. PENDERGRAM, M.D.**

**Basal Pleural Fluid Accumulations Resembling Elevated Diaphragm.** DEAN D. JONES. *Radial* 27, 1928, 502-7.

The author presents 5 cases in which fluid accumulation at the base of the lung closely simulated elevation of the diaphragm. The occurrence of a collection of fluid between the basal surface of the lung and the superior surface of the diaphragm yields a roentgenographic appearance which must be distinguished from subphrenic disease, paralysis of the diaphragm, atelectasis, eventration of the diaphragm, hernia of the diaphragm and intra-pleural or intrapulmonary neoplastic disease.

In 3 of the cases a solid density practically equal to that of the liver separated the base of the lung from the gas bubble in the stomach, while ordinarily the two are separated only by the thickness of the diaphragm. In the cases of fluid in the base of the right pleural cavity small pneumoperitoneum will reveal the under surface of the diaphragm and show a thick layer of fluid between the base of the lung and the upper diaphragmatic surface. A lateral decubitus film is also of value in order to identify the diaphragm. Under normal conditions, as fluid enters the pleural space all of the free portions of the lung tend to collapse to an equal degree. The force of gravity causes the greater part of the fluid to accumulate at the base, thinning out in the axillary line. The negative pressure resulting from retractibility of the lung is the force which opposes gravity and draws the fluid upward. Without this force, the fluid would assume a "level." In the presence of basal effusion the major factor accounting for the atypical distribution is believed to be any situation which opposes the normal retractile tendency of the major lateral, anterior and posterior surfaces of the lung. In the presence of such restraining factors, only the basal surface is free to retract and this action draws the fluid upward in a cupola shape under the base of the lung. Adhesions between the visceral and parietal layers of the pleura are believed to be the major factors. Emphysema, pulmonary fibrosis, and consolidation affect retractibility of the lung and probably influence the distribution of the pleural fluid.

**FRANK L. HOSKEY, M.D.**

**Differential Diagnosis of Retrocardiac Shadow.** STANLEY S. NIMICK. *Radiology* 1928, 502-174.

Early detection and proper evaluation of abnormal retrocardiac shadows may establish a diagnosis before the clinical signs and symptoms are present. The pericardium and the heart cast a triangular shadow on a posteroanterior roentgenogram of the chest. The heart shadow fills the entire pericardial shadow. The apparent duplication of the cardiac shadow which gives the impression of the heart visible within the pericardium is usually due to herniation of the stomach through the diaphragm, or to the rare condition of thoracic stomach with congenitally short esophagus.

A lateral roentgenogram of the chest may or may not show a definite retrocardiac opacity, but the barium meal confirms the diagnosis. The presence of multiple convex lines outlining the dome-shaped retrocardiac opacity constitutes an important diagnostic sign, indicating that the stomach is in the retrocardiac region. The convex lines show the thickness of the peritoneal sac and stomach wall, which can be demonstrated by use of the double contrast method. By utilizing the gaseous properties of carbon dioxide present in ordinary soda fountain water, adequate contrast can be secured. 8 to 16 ounces of cold carbonated water is administered. This distends the stomach so that subsequent administration of barium will outline the course and displacement of the stomach. Roentgenograms are made in the positions which will best demonstrate the length and the course of the esophagus. The use of thick barium and Trendelenburg decubitus position may be of value. Megacystophagus produces widening or reduplication of the right cardiac contour and obliteration of the right cardiophrenic angle. The opacity has a slightly convex right sided border and frequently produces a uniform widening of the right half of the mediastinal shadow, with extension, sometimes, of the shadow above the clavicle. Barium will outline the esophagus. Aortic aneurysm, tortuous aorta, and the retrocardiac stomach produce left sided widening. A large esophageal diverticulum may produce a retrocardiac shadow. Its mobility differentiates it from tumors and aneurysm. Mediastinal cysts of enteric origin produce roughly spherical opacities of homogeneous density which may extend beyond the cardiac outline. These cysts occur in infancy and early childhood and may produce pulmonary compression, and occasionally may erode the ribs. Complete atelectasis of the lower lobes presents a well known characteristic triangular retrocardiac opacity which obliterates the cardiophrenic angles. Bronchiogenic cyst appears as round uniform homogeneous opacities, usually in the upper two-thirds of the mediastinum. These may be visible through the cardiac shadow. A large tuberculoma has also been reported as casting a shadow suggestive of an aneurysm. Eccrinococcus cysts are usually larger and extend beyond the cardiac outline. Tuberculosis of the spine with associated paravertebral abscess is the most common cause of abnormal rounded or fus-

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form retrocardiac shadows in children. The typical narrowing of the intercostal spaces and the associated kyphosis make the diagnosis obvious. In adults scoliosis frequently produces duplication of either the left or the right cardiac margin. Tumors of neurogenic origin usually appear as single, sharply outlined rounded or oval nonpulsating shadows on one side of the vertebral column.

Sympathicoblastoma occurring in children may produce a round or fusiform retrocardiac shadow which may extend beyond the cardiac outline. Fibrosarcoma may produce a round retrocardiac shadow. Aneurysm of the descending aorta may be visualized through the left half of the cardiac shadow as a fusiform or globular area of opacity and may produce duplication of the cardiac shadow. The presence of longitudinal, peripheral calcifications outlining the wall of the aneurysm and bone erosion when present are of diagnostic value. Enlargement of the aorta is easily recognized. An enlarged left atrium on slightly overpenetrated films can be visualized as a distinct chamber of the heart within the cardiac shadow.

FRANK L. HURSEY M.D.

**Hiatus Hernia** S. COCHRANE SHANKS. *Brit. J. Radiol.*, 1948, 21, 55

The term hiatus hernia includes two conditions: congenital thoracic stomach and true herniation of the stomach through the esophageal hiatus. More recent work has demonstrated however that the differentiation between the two conditions is not as simple as was thought originally since the majority of the cases of short esophagus are really acquired.

The author discusses in detail the embryology and the developmental mechanism of hiatus hernia. The anatomy of the hiatus region is important. It appears that there is no cardiac sphincter in the sense of a pyloric sphincter yet some occlusive mechanism must prevent cardiac regurgitation. It is the author's opinion that three factors may enter the picture: (1) a valvelike action dependent on the obliquity of the junction of the esophagus with the stomach; (2) the diaphragmatic pinchcock which comes into effect especially when the diaphragm is in contraction during deep inspiration or when the intra-abdominal pressure is raised by abdominal muscular contraction; and (3) a physiological sphincter.

The average age of onset of herniation is from 50 to 60 years and the condition is rarely found under the age of 40. This fact alone suggests that even in the presence of a short esophagus, true congenital thoracic stomachs are rare. With increasing years many tissues lose tone and become lax. According to Schatzki the hiatus becomes widened in the elderly due to loss of fat in and around the hiatus, loss of elasticity in the latal connective tissue and stretch ing of the muscle fibers forming the hiatus. Thus in the etiology of the hiatus hernia must be sought in such an acquired defect. To this may be added the factor of increased intra-abdominal pressure, especially in obesity and pregnancy. The upward trac-

tion of the esophagus in peptic ulcer of the lower end of the esophagus and the shortening of the esophagus due to vagovagal reflexes, as, for example, from distention of the gall bladder or stretching of the gastric wall also play a definite role. It is noted that obesity, gall bladder disease and duodenal ulcer figure as the most common causes of recurrent hiatus hernia.

The symptoms of hiatus hernia are very variable. About 20 per cent of all cases show no symptoms. In the others, symptoms may appear at birth or at any time during later life. They tend to increase in severity with progress of the disease and with incarceration. In the main they may be divided into two groups: (a) the gastric group such as epigastric discomfort, belching, esophageal regurgitation and vomiting; and (b) the pressure group including palpitation, anginal pain, dyspnea, syncope and hiccup.

Harrington classifies hiatus hernia as follows: (a) congenital partial thoracic stomach with short esophagus; and (b) acquired hiatus hernia. This latter is subdivided into type I (when the esophagus is of normal length and part of the gastric fundus is herniated into the posterior mediastinum also called paraesophageal hernia), type II (in which a larger part of the stomach herniates carrying with it the esophagus which is not noticeably shortened and enters the stomach at its side), type III (in which the esophagus enters the stomach at its highest point) and type IV (in which the stomach protrudes like a funnel through the diaphragm and the esophagus enters at its highest point). There is no true hernial sac in this type.

The diagnosis of hiatus hernia is made by roentgen examination or esophagoscopy. The chief value of the latter is to check the length of the esophagus and the presence of esophageal ulcers or strictures. From the point of view of roentgen study the author distinguishes between the reducible or sliding hernia, and the irreducible or incarcerated hernia. The sliding type may easily be missed unless one sets out specifically to look for it. To detect it, examination in the supine oblique supine or Trendelenburg position is necessary with the patient's stomach partly filled with barium. When the patient is in the most satisfactory position a further bolus of the opaque medium is given and watched as it passes down the esophagus. If nothing abnormal is seen the valsalva procedure is used. A sliding hernia can be mistaken for two other conditions: a large phrenic ampulla and a mild degree of congenital short esophagus with a small contracted gastric fundus. The differentiating signs are discussed. Sooner or later most hiatus hernias become irreducible. The article is well illustrated with roentgenograms and some diagrams.

T. LEUCOTIA M.D.

**The Treatment of Keloids by Irradiation and Electrosurgery** GEORGE E. FRANKEL and GEORGE P. KEEFER. *Am. J. Roent.*, 1948, 59, 378.

Keloids or hypertrophied scars are difficult to treat. It requires great patience on the part of both

the patient and the physician. So far as is known roentgen rays and radium are the only two agents which will arrest the disease or cause it to disappear. If these agents are used thoroughly when the scar begins to hypertrophy there will probably be no need of combining excision or electrosurgery with the radiotherapy.

Electrodesiccation or electrosurgery are used to reduce the hypertrophied tissue to skin level prior to roentgen irradiation.

Treatment is given with superficial or 155 kilovolt therapy. For postoperative irradiation, 50 to 100 per cent of an erythema dose is given. If the wound is healing by granulation, 50 per cent of erythema dose is given in 2 weeks and this dose can be repeated in from 2 to 4 weeks if any tendency toward hypertrophy persists. Older flattened keloids are treated with similar increments at 4 to 6 week intervals. Thicker old keloids are treated with small increments at weekly intervals. The purpose of this method of treatment is to bring about change without prominent atrophy or telangiectasia.

Flat radium application is filtered to eliminate the beta rays can also be used effectively.

If the keloids or hypertrophied scars are very dense it is usually best to destroy the lesions to the level of the skin by electrodesiccation or to remove them with scalpel or electrosurgery. The healing then must be carefully controlled by irradiation generally by roentgen therapy.

JOSEPH P. TORIKUJA, M.D.

**Roentgenological Aspect of Sarcoidosis.** ALFRED J. ACKERMAN. *Am J Roentg*, 1948, 59: 3 B.

The author presents a discussion of the clinical aspects of sarcoidosis, particularly with regard to the pulmonary manifestations of the condition as seen in the roentgenogram.

The great individual differences in the distribution, extent, and character of the lesions are believed to be due to the evolutionary stages of the disease. Early lesions may not be seen because of the frequently asymptomatic course and sarcoidosis may be well advanced when it is first discovered. Extended observation will reveal the fluctuating course of the disease. New lesions may appear at any time and older ones may change or regress.

Frequently all manifestations, including enlargement of the mediastinal nodes, millary infiltration, areas of fibrosis, and confluent areas of patchy infiltration may be observed at one time in the same patient.

Enlargement of mediastinal nodes is quite characteristic, frequently with increase in mediastinal dimensions. This increase is usually bilateral and symmetrical, but may exist on one side only. The size ranges from mere hilar enlargement to large tumor masses extending into the lung fields. Pressure symptoms are usually lacking. Spontaneous complete regression of these masses may occur. In spite of the extensive evidence of disease symptoms are often absent.

The pulmonary manifestations of sarcoidosis are not pathognomonic per se. Changes are rarely uniform and no form of infiltration can be attributed to a specific stage of the disease. The distribution can be local or rather extensive in any phase. Single aspects of infiltration may occur without node involvement in phases of the disease.

Diffusely disseminated infiltrates consist of discrete small nodular foci resembling the nodules of millary tuberculosis. The distribution of such lesions may take any form. Diffuse or localized infiltrations of a linear or strandlike character seem to follow the distribution of the vascular pattern and are seen as prominent root trunks. Confluent patchy densities are usually seen with widespread peribronchial-perivascular and nodular infiltrations.

The various types of pulmonary lesions represent only manifestations of different stages of evolution. A complete absorption of some areas of infiltration is seen almost invariably in cases remaining under long observation.

Frequently the myocardium and pericardium are invaded by sarcoid resulting in arrhythmias, conduction defects, cardiac enlargement, and right cardiac failure.

Skeletal changes occur in 20 per cent of cases of sarcoidosis. The author did not observe such changes in his series of 19 cases. The bone changes may be of the punched-out type or of the diffuse variety.

Four cases are presented in detail. The author concludes that the diagnosis may be established only by biopsy and that the prognosis in pulmonary sarcoid must be guarded. HORACE G. BUTLER, M.D.

**Tissue-Dosage in Roentgentherapy of Mammary Cancer.** MAURICE LEVY. *Acta radiol* Stockh., 1947 38: 583.

There is still no agreement as to the exact amount of roentgen therapy required (when used alone or combined with mastectomy) for preoperative or postoperative treatment of mammary cancer. Results vary chiefly with the extent of the cancer prior to irradiation and with the dosage delivered to the tumor.

Postoperative irradiation is given in the hope of arresting clinically nonrecognizable foci in the mastectomy area, axillary tissues, supraclavicular and infraclavicular lymph nodes, or in the lymph nodes of the anterior mediastinal or internal mammary chain. Progressive growth of distant metastases, if present when therapy is begun, is not influenced by any local improvement in the irradiated areas.

Reference is made to the experience of McWhirter (*Edinburgh M J* 1942 50: 193-207) which suggests that important growth restraint for at least 3 years may be obtained by a tissue dose of from 3,500 to 4,500 roentgens given in 4 weeks.

Between 1933 and 1937, preoperative irradiation was given to 38 patients. The breast and axilla received up to, but not exceeding, a 4,500 roentgen tumor dose in 6 to 8 weeks and mastectomy was done from a few days to more than one year later.

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In 9 specimens with biopsy and mastectomy, comparisons were made by means of biopsy and mastectomy and Stout found cancer cells could be demonstrated in every one.

Since 1938 only inoperable cases fitting the Haagenson-Stout classification have been treated. Fifteen patients received less than from 5,500 and 8,000 roentgens to the breast. The axillae were cross fired through anterior posterior and direct fields with doses varying between 2,500 and 5,000 roentgens in air.

Of the 32 patients receiving a tumor dose of between 5,500 and 8,000 roentgens, 10 are now alive and free from clinical evidence of cancer from 7 to 9 years after their irradiation therapy. No claim is made that they are cured. Cancer cells may still persist within a dense sclerotic stroma.

In view of these findings radical mastectomy is to be preferred in all operable cancers of the breast. In inoperable cases only roentgen therapy should be used.

J. P. TOMSULA, M.D.

## Studies on the Effects of Radiation upon the Mobile Visible Lipids in Human Blood. KAR SÄTÄLÄ. *Ann. med. exp. biol. fenn.*, 1947, 25 Supp. 1

An attempt was made to inquire into the effects of roentgen or radium treatment on the mobile visible blood lipids before the lipids were deposited in the liver or in other bodily organs. Subjects of the investigation were 32 individuals who were in the same hospital (Central Institute for Radiation Therapy Helsinki) and who presented the same external conditions during the whole observation and treatment period.

As a method of investigation no chemical quantitative determinations were chosen, but in all persons the amount of chylomicron in the blood was counted every half hour. Though the chemical character of chylomicrons is not finally solved there are now ever solid proofs of the truth of the assumption that at least the majority of them are formed of lipids. The amount of chylomicrons was always in direct

proportion to the amount of fat taken. The examination of the blood was always performed by the same person with the same instruments.

It was found that roentgen as well as radium irradiation regularly caused changes in the amount and in the metabolism of mobile visible blood lipids of both healthy and tumor bearing individuals. Further it was found that if changes were to be attained irradiation must be given in certain relation to the fatty food taken. It appeared also that when certain regions of the body were irradiated such as the lower abdomen, the liver the chest and especially organs in which the tumors were in the necrotic phase the changes were most considerable.

In seeking an explanation to the phenomena described the histamine theory was also used as a basis in this work. Histamine acid phosphate was injected intramuscularly to the test individuals. It appeared that the histamine administration when performed at a suitable period effected marked changes in the lipid amount and in the lipid metabolism in the blood of both healthy and tumor-bearing individuals.

In those persons who exhibited symptoms indicating irradiation sickness, the changes were particularly severe.

The author assumes that the decrease or disappearance of the mobile visible blood lipids may partly be an effect of the hemoconcentration of the blood owing to the probably increased permeability of the capillaries and that it is caused by irradiation or the administration of histamine. At the same time the blood plasma passes through the injured capillary walls. Chylomicrons may also pass with the plasma. Particularly striking was the fact that after irradiation as well as after administration of histamine and the effect usually appeared comparatively soon. The effects of the histamine sometimes remained for a period of several hours.

The effects of irradiation or histamine (or both) are hardly direct as regards the liver.

J. P. TOMSULA, M.D.

## MISCELLANEOUS

### CLINICAL ENTITIES—GENERAL PHYSIOLOGICAL CONDITIONS

The Control of Body Water Balance. CHAMBERLAIN BROOKS. *Med. J. Australia*, 1948, 1: 87

Many phases of the physiology of the control of body water balance are presented. Water is the chief body component; it comprises 70 per cent of man's total weight. It is the medium for the exchange and metabolism of many organic solutes and the solvent essential to chemical reactions upon which life depends. Extracellular fluid constitutes 20 per cent of the body weight and consists of the intravascular fluid approximating 5 per cent of this, while the interstitial fluid makes up the other 15 per cent. The water contained within the cells as a component of protoplasm is bound more firmly to its location than the extracellular fluid and constitutes about 50 per cent of the total body weight. The volume of water within these compartments may be ascertained at any one time by the use of blue dye T 1824, sulfoocyanate, radioactive sodium, sucrose, urea, or deuterium oxide. The type of substance dissolved in or held by the water of these three compartments differs, but that is because of the selective permeability of membranes and other factors. Intracellular fluid contains potassium as its chief cation, and phosphate and protein as the main anions, while extracellular fluid contains chiefly sodium, chloride, and bicarbonate. The movement of various substances such as salts, urea, and proteins cause water to move along with them, and salt depletion or salt excess greatly alters the water volume content of the extracellular and intracellular compartments.

Man can probably withstand to 25 per cent reduction of his total body water before collapsing, but from 2 to 4 per cent reduction of body weight has measurable consequences such as increased heart rate, elevation of deep body temperature, diminished cardiac output, exhaustion and, finally, mental instability and depression. The blood loses two or three times as much of its volume as does the body as a whole. In mammals the only natural route of water gain from outside is through the alimentary tract and water ingested into an empty tract is absorbed within 40 to 60 minutes. Hypophysectomy prolongs total absorption by at least 50 per cent. Man averages approximately 1,500 milliliters of fluid—water, milk, tea, or coffee—daily but under desert conditions intakes up to 15 liters daily have been reported. Meat affords man 75 per cent of its weight in water, and vegetables, 50 per cent. Normally the individual obtains about 1,000 milliliters of water in this way. Finally, he manufactures water in the process of metabolizing food materials. In burning 100 grams of protein 31 grams of water are obtained, and every 100 grams of fat yields 107 gms of water while 100 grams of carbohydrate

yields about 60 grams of water. The total gain daily through normal metabolism yields about 300 milliliters.

Water is lost from the body in several ways. Insensible loss or evaporation loss averages normally 900 milliliters daily but under conditions of dry heat may approximate 1,500 milliliters. Respiratory loss approximates 400 milliliters. In hot, moist atmospheres over 3 liters of sweat may be secreted per hour. Under desert conditions men may lose as much as 11 liters of fluid in sweat each day. As men become acclimatized to heat they lose more sweat than they did before. The maximal rate of sweating without water can be attained within 20 minutes, but after 2 hours of maximal sweating the rate declines and at 6 hours the rate is so slow that cooling fails. The normal urine output is about 1,400 milliliters but this varies greatly with water requirements.

In conclusion, the author discusses the physiology associated with diabetes insipidus. Its production is mediated through interruption or injury to the hypothalamohypophyseal system with resultant deficiency of the antidiuretic hormone.

EDMUND A. GORVETT, M.D.

The Functional Pathology of Experimental Immersion Foot. KURT LARSEN, DAVID WERNER, and LOUIS J. BOND. *Am. Heart J.* 1948, 35: 38.

The authors investigated the functional pathology of trenchfoot by exposing the legs of rabbits to water at a temperature of from 3 to 5° C. for 3 or 4 days. The temperature of the exposed limbs rapidly dropped but leveled off at about 15° C. Some circulation persisted throughout, as shown by fluorescein injection and by the appearance of edema (this can only appear in the presence of a positive filtration pressure). Upon removal from the water the legs showed severe edema and a flaccid paralysis and soon became very hyperemic. The edema subsided in 2 days but the loss of muscular power persisted for from 4 to 12 weeks in most animals. There was no gangrene except in areas of superimposed trauma and infection. Histologic sections showed no vascular thrombi, which are so characteristic of frostbite. Lesions seemed confined to muscle and predominantly to the nerve tissue, in which severe degenerative changes were found for weeks following the exposure. The temperature of blood from a leg during exposure was almost the same as the internal temperature of the leg. At a temperature of from 6° to 8° C., the oxygen dissociation of the blood is very low and in fact, venous blood from the legs during exposure was observed to be a bright red.

Some of the animals showed a marked decrease of body temperature during the exposure. When this fell to between 34 and 35° C., deep depression of the S-T segments in all leads of the electrocardiograph was seen; this was followed by an elevation of the

S-T segment with inverted T waves as are seen in myocardial infarctions (anoxia of the myocardium?) Morphologic examination of the hearts in these animals has thus far failed to show any specific lesion.

The authors conclude that the lesions of experimental trenchfoot are different from those of frost bite in that the former are characterized by muscular and neural injury due to tissue anoxia secondary to decreased circulation and poor oxygen dissociation, whereas the latter are the result of multiple vascular thrombi and total failure of the local circulation with resultant gangrene. Frostbite is due to sudden extreme cold and trenchfoot to prolonged lesser cold but the two may overlap. JAMES WEAVER, M.D.

**The Effect of Local Compression upon Blood Flow in the Extremities of Man.** MEYER H. HALPERIN, CARL K. FRIEDLAND, and ROBERT W. WILKINS. *Am. Heart J.*, 1948, 35: 221.

When 5 individuals were subjected to increases of pressure on one hand by a plethysmograph there was an average reduction in skin temperature of the fingers of about 1 degree centigrade as compared with the control hand with a pressure of 30 mm. of mercury. A definite reduction was also elicited by 20 mm. of pressure. In 2 subjects a mean drop of 4.8 degrees centigrade between the two hands was effected by subjecting one hand to 50 mm. of pressure.

Blood flow through an organ may be determined from its oxygen uptake. In 5 subjects there was an average decrease in the oxygen content of venous blood from the antecubital fossa when pressures of 20 and 30 mm. of mercury were applied to the forearm with the circulation of the hand shut off throughout such as would signify decreases of blood flow of 25 and 34 per cent respectively.

When measurement of the absolute blood flow was made by recording on a kymograph the volume of the forearm with a water plethysmograph (under an unavoidable initial pressure of 8½ centimeters of water) with the hand circulation again occluded completely by a cuff about the wrist, it was found that a decrease of 10 per cent occurred in the flow of blood through the forearm when a pressure of 10 mm. of mercury was applied by another cuff above the plethysmograph. Pressures of 20 and 30 mm. reduced the flow 24 per cent and 40 per cent respectively.

These experiments show the importance of small increments of pressure (as small as 10 mm. of mercury) in the reduction of peripheral blood flow such as might be induced by snug clothing, bandages, splints, or even the weight of bed clothes on bony prominences. These results assume particular significance with patients who already suffer from peripheral vascular disease. JAMES WEAVER, M.D.

**Pentothal Sodium and Serotherapy in the Treatment of Tetanus.** (Pentothal sodium e sieroterapia nel trattamento del tetano). G. CADILLI. *Minerva med.* Tor. 1948, 39: 12.

The combination of serum therapy with the employment of sedatives was introduced into the treat-

ment of tetanus by Dufour and Duhamel in 1925, with the idea that the sedative effect changes the cellular metabolism and thus facilitates the action of antitoxin on the tetanus toxin. Numerous observations showed that sedatives liberate in vitro the tetanus toxin from the brain substance. However, in vivo the administration of the combination of serum and either chloroform, or ethyl chloride, respectively did not fulfill the expectation.

The author studied the effect of pentothal sodium on tetanus in rabbits. He employed 40 mgm. of sodium pentothal per kilogram of body weight in a 2.5 per cent solution. This dose was given intravenously within from 20 to 30 minutes. The author found that the rabbits survived the lethal dose of tetanus toxin if sodium pentothal was administered within 45 hours after the injection. The total dose of sodium pentothal ranged from 112 to 256 mgm. The amount of serum administered to rabbits was 1,500 units in one group and 10,000 units in the second group. The serum was administered between 18 and 87 hours after the infection.

The good results suggest a similar treatment in man. JOSEPH K. NARAT, M.D.

**Superficial Total Lymphangiectomy. Surgical Treatment of Elephantiasis.** (La lymphangectomie superficielle totale. Traitement chirurgical de l'elephantiasis). M. SCRIVELLE. *Rev. chir. Par.* 1947, 66: 394.

Since at the beginning of this century it was realized that elephantiasis is due to lymphostasis, various surgical methods have been devised for treatment. Most of these operations have for their purpose the drainage of the stagnating lymph. The insertion of long silk strands or rubber tubes in the subcutaneous tissue from the ankle to the anterior abdominal wall was tried without much success. Other surgeons resected a wide strip of the superficial aponeurosis and edematous tissue in the attempt to drain the edema toward the deep lymphatic vessels. Furthermore lumbar and perilemoral sympathectomy has been done by several men. All of these methods proved unsuccessful in curing the lymphostasis and ensuing elephantiasis.

The author has devised a new method for the treatment of elephantiasis which he calls "superficial total lymphangiectomy" and he reports a series of 25 cases (19 of the leg, 1 of the arm, and 5 of the penis and scrotum) in which this operation led to excellent results.

Lymphography and fluoroscopy of the lymphatics proved very helpful in understanding the mechanism and pathogenesis of elephantiasis and in determining the extent and site of the dilated lymph vessels. A syringe is inserted in a dilated lymph vessel and a large amount of lymph up to 1,500 c.c. in some cases, is drawn and replaced by the contrast medium which is injected through the same needle. In true elephantiasis the superficial lymphatics show tremendous dilatation and hypertrophy often having the caliber of a finger. Due to this extreme dilatation



the valves of the vessels become incompetent, and the lymph circulation normally somewhat slower than the venous circulation, stops altogether.

As to the etiology most case histories reveal that the trouble started after some minor infected skin abrasion, insect bite, or similar lesion which caused an adenitis of the regional lymph nodes (inguinal iliac). Very gradually fibrosis of the lymph nodes leads to obstruction of the lymphatics and blocks the circulation.

Before a decision is made regarding the kind of management required it should be verified whether the case is a true elephantiasis, i.e. a lymphostasis or an edema caused by a phlebotic process. Therefore in all doubtful cases a venography should be done in addition to the lymphography.

In true elephantiasis, the treatment of choice is total resection of all the lymphatic tissue involved and of the superficial aponeurosis. The operation is done in two stages: (1) incision from the major trochanter down to the external malleolus, the epidermis and dermis being dissected from the underlying tissue back to the midline anteriorly and posteriorly and the entire subcutaneous tissue including the superficial aponeurosis is removed in one block, and (2) after 3 months, the same operation is done at the medial aspect of the leg.

This is a formidable operation which necessitates blood transfusions before and after surgery. However, in 30 such operations the author has obtained excellent results. W. V. M. SLEWITZ, M.D.

**The Calcified Halo: Diagnostic Sign of Hydatid Cysts of the Liver and the Operative Approach to Large Cysts of the Superior and Posterior Surfaces of the Liver** (El halo calcico. Signo de diagnóstico en los quistes hidatídicos del hígado y sobre la vía operatoria de abordaje en los grandes quistes de la cara superior y posterior del hígado). D. PRAT, L. C. RUBA, and E. ZERBONI. *Acta Medica* 947:3, 336.

In the roentgenograms of some patients with hydatid cyst of the liver there is seen evidence of spherical tumors with well demarcated outlines. These have been named calcified halos. This difference in density which totally surrounds the cyst or at times only partially is due to an accumulation of calcified material in the wall of the cyst.

The first films of hepatic cysts with a calcified halo which were observed were classified by the radiologist as calcified cysts of the liver. It was finally shown at operation that these cysts were not actually calcified as the capsules were soft and malleable, but they contained a high concentration of calcium in their walls. An additional sign of extreme importance in cysts of the posteroinferior aspect of the liver is downward displacement of the kidney demonstrated by intravenous pyelography.

The anterior or posterior parapleural approach is the surgical procedure of choice for cysts of the superior or posterior surfaces of the liver. This may be carried out under general or local anesthesia.

In those cases in which there are cysts of the superior surface of the liver which may not be approached via the abdomen the operative approach is made through the anterior thorax with resection of the seventh, eighth, or ninth rib after the anterosuperior position of the cyst is confirmed by a profile roentgen film.

Choice of the rib to be resected depends upon the actual location of the cyst. This resection permits elevation of the pleural sac. The diaphragm and peritoneum are incised and the anterosuperior surface of the liver is exposed. By this method an adequate operative field is obtained.

With large cysts of the posteroinferior surfaces of the liver the parapleural approach may be used to advantage. With the patient in the left lateral decubitus position a posterior thoracolumbar incision is made. The twelfth or eleventh rib, usually the latter is resected. The roof of the inferior pleural sac is raised the diaphragm incised, and the liver exposed.

The case histories and operative notes of 9 patients are presented. Three of the patients had hydatid cysts of the posterosuperior surface of the liver. One had an amebic abscess. All of these patients were operated upon through the posterior parapleural approach. Five of the patients had hydatid cysts of the superior surface of the liver and these were operated upon through the anterior parapleural approach.

HAROLD W. BICKNELL, M.D.

**Myeloplaxoma with Malignant Transformation** (Tumore a mieloplasmi in orientamento maligno). FABIO T. BRANT and GIOVANNI BELLECCI. *Rivista Med. Milano*, 913, 34, 9.

A case of myeloplaxoma with malignant transformation in a 37 year old female is described by the authors.

At 18 years of age this patient had an injury to the second toe developing a hematoma which finally disappeared.

Seven years after injury and during the first of her 4 pregnancies she observed a tumor on the dorsal surface of the first phalanx of the second toe. Pain was present throughout her pregnancy and subsided after delivery only to become worse with each succeeding pregnancy, the tumor finally reaching the size of a walnut. The pain became intense after her fourth delivery. Passive movements were possible and active movements were reduced.

The tumor became adherent to the skin which was of a bluish color. It was fusiform in shape and had a hard consistency.

Roentgenography showed without doubt that the tumor was malignant because it broke through the osseous tissue and invaded the soft tissue. No signs of periosteal reaction were observed.

A disarticulation of the second toe was done.

On section the tumor was found to be brownish red with clear brown zones toward the center of the mass. The base of the tumor was situated over the bone.

Microscopically the connective tissue was dense having a few nuclei however the part near the epidermis contained multinucleated cells with little protoplasm. These cells contained from 5 to 10 nuclei of dense chromatin and of equal size. The cells stained strongly acidophilic however, some were weakly basophilic, and still others were chromophilic.

The author calls particular attention to the trauma and pregnancy relationship of the tumor, and to the rarity and difficulty of the clinicoradiologicohistological diagnosis. This condition had to be differentiated from tuberculosis syphilis solitary cyst of the bone, Bruno tumor chondroma, giant-cell tumor, polymorphous giant-cell sarcoma, fibrosarcoma, and reticulosarcoma.

ARTHUR F. CIPOLLA, M.D.

### GENERAL BACTERIAL, PROTOZOAN AND PARASITIC INFECTIONS

**Nose and Skin Carriage of Staphylococcus Aureus in Patients Receiving Penicillin** BRENDA MOSS, J. R. SQUIRE, ELIZABETH TOPLAY and C. M. JOHNSON *Lancet, Lond., 1948, 1, 320.*

The frequent isolation of the Staphylococcus aureus (coagulase-positive Staphylococcus) in pure culture from many purulent lesions including osteomyelitis is strong evidence of the pathogenicity of this organism to man. Swabbing large and varying samples of the adult population has repeatedly revealed a high incidence of this organism in the nose and a high incidence of the staphylococci isolated from the nose and skin of one person usually shows them to be of the same type. This suggests the hypothesis that the staphylococci found on normal skin are usually derived from the nose, probably by direct contact.

The authors gave penicillin experimentally through the nose to reduce the associated findings on the skin aureus and noted the associated findings on the skin. The normal skin site used was the back of the wrist. Penicillin cream or spray in a total of from 50,000 to 100,000 units over 10 days reduced detectable nasal carriage of the Staphylococcus aureus in a group of 21 persistent carriers. However systemic administration of penicillin in a daily dosage of 100,000 units failed to influence nose or skin carriage of the Staphylococcus aureus in 15 patients. This failure may be explained on the hypothesis that the site of the Staphylococcus aureus on the epithelium of the skin and the nose is not reached by any transudate from the capillary blood. In support of this it has been shown that neither human sweat nor cat's tears contain any demonstrable penicillin after systemic injection. The reduction of the nasal carriage of Staphylococcus aureus following the intranasal use of penicillin was associated with a significant fall in the number of organisms on the normal skin in 8 of 13 persistent nasal carriers. This suggests that the nose was the predominant source of this organism on the wrist.

In the 5 patients in whom the intranasal use of penicillin was a failure, the close association between

nose and skin carriage could be due to colonization of either or both sites. It is well known that Staphylococcus aureus can always be isolated from healed as well as from healing wounds and burns. There also are persons with intact skin who carry this organism with an abnormal heaviness and persistence in a multiplicity of sites. It is clear that the incidence and significance of Staphylococcus aureus skin colonization require further investigation.

A much higher incidence of the Staphylococcus aureus was found in the nasal vestibule than in the middle fossa of the nose. This suggests that the squamous epithelium of the vestibule is the primary site of colonization. It is suggested that the therapeutic or prophylactic value of intranasal administration of penicillin be evaluated for the prevention of staphylococcal contamination of skin surfaces in burns and other skin lesions.

EDMUND A. GORVETT, M.D.

**The Bactericidal Action of Streptomycin** LAWRENCE P. GARROD *Brit. M. J., 1948, 1, 383*

In so far as the action of a chemotherapeutic agent is bactericidal that action must be influenced by various factors such as concentration, temperature, medium, and inoculum size, which are known to affect chemical disinfection generally. Experiments were undertaken to provide information on these points with regard to streptomycin. The organism used was the Staphylococcus aureus (Oxford H strain) the inoculum being derived from a 24 hour culture in ox heart-extract peptone broth. The basis of the test mixture was usually the same broth to which was added streptomycin and such an amount of culture as to give an initial viable count of about 50,000,000 per milliliter.

Viable counts were made at intervals. Curves showing the fall in the viable count of the Staphylococcus aureus are given with four different concentrations of streptomycin. An original population of 95,000,000 per milliliter was entirely extinguished by 200g per milliliter in 8 hours by 50 or 100g per milliliter in 4 hours and by 200g per milliliter in 2 hours. With 2,000g per milliliter a rather large inoculum which was only partially extinguished with 200g per milliliter was completely extinguished. It appears that the death rate varies with the concentration of the drug and the action therefore differs radically from that of penicillin which is not accelerated by increase in concentration above a certain level.

All bactericidal action is accelerated by increase in temperature and streptomycin makes no exception to this rule. The viable count decreased as the temperature increased. The effects of streptomycin on the death rate of different species were notably the same when the Bacterium coli and the Streptococcus pyogenes were used as when the Staphylococcus aureus was used under the same conditions. In order to determine the effect of other media, broth culture of the Staphylococcus aureus was thoroughly washed (centrifuged 3 times and resuspended

saline solution) and the suspension was added to defibrinated blood or serum containing 5000g of streptomycin per milliliter. It was found that the rate of fall in the viable count approximated closely that observed in the broth. In urine (sterilized by filtration and adjusted to pH 7.4) the effect was similar but less rapid. On the other hand washed culture added to saline solution containing 5000g of streptomycin per milliliter was completely unaffected; the viable count as in the saline control containing no streptomycin remained almost stationary throughout the whole experiment. With higher concentrations of streptomycin in a nonnutrient medium, it appears that very high concentrations of streptomycin are incompletely and irregularly bactericidal. In its dependence on a nutrient medium for rapid bactericidal action streptomycin resembles penicillin, but there is a striking difference in their effects. The effect of penicillin becomes evident only after a lapse of time amounting to about one hour while that of streptomycin is immediate—under favorable conditions it begins within one minute and may be far advanced in 10 minutes. No other bactericidal agent having so rapid an effect is so dependent on a nutrient medium for its efficacy. This peculiar behavior will have to be taken into account in any hy-

pothesis about the mode of action of streptomycin. That the size of the inoculum affects the concentration of streptomycin required to inhibit growth was shown. Tests revealed that the absolute concentration of streptomycin was not the determining factor; it is the relation between that concentration and the number of bacteria. It appears that a given concentration of streptomycin can kill only a population of a certain density; if more are present some will survive.

The fact that higher concentrations of streptomycin are more rapidly bactericidal has an important bearing on treatment. Streptomycin, like penicillin, is excreted in the urine where it attains a high concentration. If its effect *in vivo* parallels that described *in vitro*, susceptible bacteria should disappear rapidly from the urine soon after excretion has begun. After 6, 8 or 12 hours if treatment is going to be successful the urine is completely sterile. If treatment is to fail specimens continue to yield counts of a few hundreds or thousands per milliliter until the second day when there is a sharp rise and the organism is found to be already much more resistant. It seems as if the issue is settled one way or the other within 24 hours or less.

EDWARD A. GOVETT, M.D.



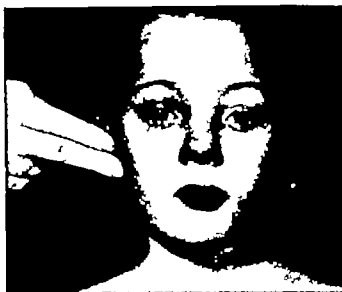


Fig. 1

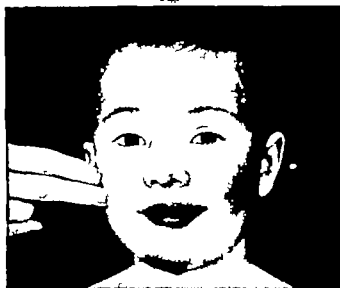


Fig. 2

Fig. 1. Preoperative photograph of a 6 year old child from France who had extreme cyanosis and disability.

Fig. 2. Photograph 5 days after operation, showing great diminution in the cyanosis. The patient is very much improved.

*Surgical Procedures Employed and Anatomical Variations  
Encountered in the Treatment of Congenital Pulmonary Stenosis*  
—Alfred Blalock

# SURGERY

## GYNECOLOGY AND OBSTETRICS

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### SURGICAL PROCEDURES EMPLOYED AND ANATOMICAL VARIATIONS ENCOUNTERED IN THE TREATMENT OF CONGENITAL PULMONIC STENOSIS

ALFRED BLALOCK, M.D. F.A.C.S., Baltimore, Maryland

THROUGH the generosity of the Nu Sigma Fraternity at Tulane University it is my good fortune to be invited to deliver the first Rudolph Matas Lecture. I regard this opportunity as a great privilege imperfectly as I shall be able to meet its obligations for the friendship and leadership of Dr. Matas have been for me as well as for surgeons throughout the world a dear possession and a strong influence. I take delight in the thought that the late Professor Halsted would be pleased that one of his pupils should inaugurate a lectureship which hon-



Rudolph Matas

ors the name of the close friend for whom he had the greatest admiration. Because they were bound together by various ties, the visits of Dr. Matas to Baltimore were frequent. It is to be feared that as medical students we failed to appreciate fully the high value of the clinics conducted by this distinguished visitor on endoaneurysmorrhaphy, on methods for determining and increasing the collateral circulation in the presence of aneurysm, on the use of metal bands in the treatment of aneurysm and on the causes of elephantiasis, all problems in which he and Dr. Halsted were deeply interested. It

The first Rudolph Matas Lecture, established by Beta Iota Chapter, Nu Sigma Nu, delivered at New Orleans on January 8, 1948.

From the Department of Surgery of The Johns Hopkins University and The Johns Hopkins Hospital.

Added by a gift from the Robert Garrett Fund for the Surgical Treatment of Children and the Carolyn Rose Strauss Foundation, Inc. grant for Diagnosis and Treatment of Congenital Cardiovascular Defects.

may be of significance that one of the students present at these clinics, Dr. Arthur Blakemore, has made what is probably the most important contribution to the treatment of aneurysm since the work of Dr. Matas. The death of Dr. Halsted in 1922 ended a beautiful

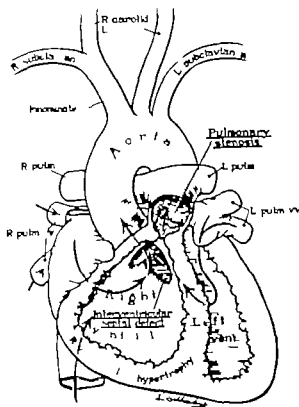


Fig. 3. A diagram of the tetralogy of Fallot showing pulmonary stenosis in the conus region, an interventricular septal defect, aorta which overrides the ventricular septum and hence which receives mixed blood as well as arterial blood, and right ventricular hypertrophy. The cyanosis is due to the fact that the aorta receives inadequately oxygenated blood from the right ventricle as well as to the fact that the pulmonary blood flow is small as result of the pulmonary stenosis or atresia.

friendship and it was fitting that Dr. Matas should give the principal address on the occasion of the memorial service.

The surgical interests of Dr. Matas have not been limited to problems of the vascular system. In order to emphasize the variety and the importance of his contribution it is necessary merely to mention his pioneer work on continuous intravenous therapy in the care of surgical patients; on the use of an indwelling tube for decompressing the intestinal tract; on the employment of spinal anesthesia; and on the use of motion pictures as a means of teaching.

One of the occasions which I regret most to have missed was the meeting of the International Society of Surgery in 1939 at the time

when Dr. Matas was President of this most distinguished of international surgical organizations. A number of those fortunate enough to be there have told me of the success of the meeting, of the universal popularity of the President and of his remarkable success as a linguist and a presiding officer. It was my good fortune to be present last September at the meeting of the International Society of Surgery in London, and I shall never forget the acclaim accorded Dr. Matas. There was no doubt as to the place which he occupied in the affection and esteem of everyone. The members of Nu Sigma Nu are both fortunate and wise in their choice of a name for this lectureship in that they are honoring a native son, the leading citizen of Louisiana, a former professor of surgery at Tulane, and one of the foremost figures in the surgical world today.

Whereas most of the publications of Dr. Matas have dealt with acquired cardiovascular disorders, this lecture will be limited to a consideration of congenital defects with particular reference to pulmonic stenosis and associated abnormalities. Major attention will be focused on technical methods by which the flow of blood to the lungs may be increased and on the anomalies of systemic and pulmonary blood vessels which have been observed during the course of such operations.

At the present time there are only three general types of congenital cardiovascular defects which are amenable to surgical treatment. I refer first to patent ductus arteriosus, in which the shunt is from the aorta to the pulmonary artery and hence in which there is no cyanosis. The work of the left ventricle is greatly increased, heart failure may supervene, and obviously the treatment consists of closure of the patent ductus. The second type which responds favorably to surgical treatment is coarctation of the aorta. Marked constriction or atresia of the thoracic aorta causes hypertension in the upper part of the body and hypotension in the lower part. There is no shunt of blood from the lesser to the greater circulation and hence there is no cyanosis. The preferred treatment consists of excision of the stenotic area and end-to-end anastomosis between the proximal and distal segments of the aorta. The third general type of abnor-

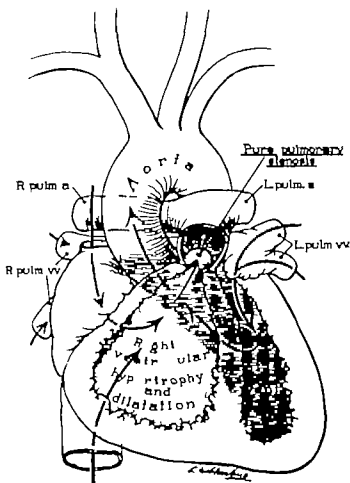


Fig. 4. Pure pulmonary stenosis, a relatively rare lesion in which the stenosis is usually in the pulmonary valve. Since there is not an interventricular defect and the aorta does not receive mixed venous blood, cyanosis is not a prominent feature. Patients with pure pulmonic stenosis would not be greatly benefited by the creation of an artificial ductus arteriosus.

malities which may be treated by operative means is that in which there is an inadequate pulmonary blood flow and in which mixed venous blood enters the arterial circulation. The most frequently encountered condition of this type is the tetralogy of Fallot in which there is pulmonic stenosis or atresia, an interventricular septal defect, an aorta which overrides the septal defect and receives blood from both ventricles, and right ventricular hypertrophy. Preoperative and postoperative photographs of a child with this condition are presented in Figures 1 and 2 (frontspective). It is estimated that approximately 70 per cent of patients 2 years of age and over who are cyanotic on the basis of congenital heart disease have this combination of defects. A diagram is given in Figure 3

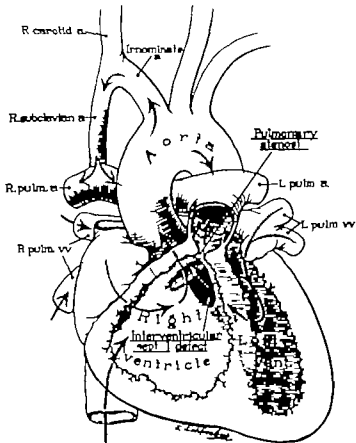


Fig. 5. Showing the alteration in the circulation which results following the creation of an artificial ductus arteriosus in the treatment of the tetralogy of Fallot. The illustration shows an anastomosis between the proximal end of the subclavian artery and the side of the right pulmonary artery which allows the shunted blood to pass to the right or the left lung. The quantity of inadequately oxygenated blood which is exposed to the oxygen in the lungs is greatly increased. Fortunately the pressure in the aorta and its branches is high, that in the pulmonary artery is low and a large quantity of blood passes through an opening of moderate size. One may use one of the large branches of the arch of the aorta or the aorta itself for the anastomosis.

Since the pulmonic stenosis is the major defect in the tetralogy of Fallot, I wish to emphasize the point that the cyanosis is due primarily to the fact that there is an interventricular defect with an overriding aorta which receives mixed venous blood from the right ventricle as well as oxygenated blood from the left ventricle. The severity of the cyanosis depends in addition to other conditions upon the degree of the pulmonic stenosis and the degree of overriding of the aorta. It is known that at least 5 grams of reduced hemoglobin per 100 cubic centimeters of circulating blood are necessary in order to produce obvious cyanosis. In pure pulmonic stenosis in which there is no communication between the two





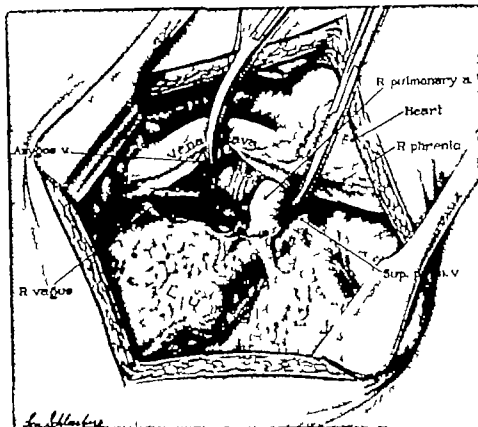


Fig. 7 Showing the right pulmonary artery. It lies superior and slightly posterior to the superior pulmonary vein. Identification of these two structures may be difficult when the pulmonary artery is small and when there are extensive collateral arterial vessels. A long length of the right pulmonary artery is dissected free of the adjacent tissues and the point of division of the artery is exposed.

bronchial arteries and with a rudimentary pulmonary artery with which an anastomosis can be performed transposition of the aorta and pulmonary artery in association with a large interventricular defect and pulmonic stenosis and numerous variations in these defects. It is possible that patients with a normal or increased pulmonary blood flow in association with an interventricular septal defect and an overriding aorta (as in the Eisenmenger complex) may be improved somewhat by the creation of an artificial ductus arteriosus. This point has not been determined. Certainly the primary indication for the operation is an inadequate flow of blood to the lungs and an interventricular defect with an overriding aorta.

Clinical laboratory and radiological evidences of the presence of pulmonic stenosis or atresia have been described in detail by Dr. Taussig and by others. Included among the important positive points in the typical case are cyanosis, dyspnea, poor exercise toler-

ance, squatting, low arterial oxygen saturation, polycythemia, a systolic murmur in the pulmonary area, a concavity in the pulmonary area on x-ray examination, a clear pulmonary window in the left anterior oblique position, diminished hilar shadows, and absence of pulsations at the hili of the lungs on fluoroscopic examination. A useful laboratory procedure described recently by Dr. Bing and his associates is the finding that the oxygen consumption per liter of ventilation decreases with exercise in patients with the tetralogy of Fallot, whereas it increases in those without pulmonic stenosis. A history of squatting following exertion is given by the great majority of patients with inadequate pulmonary blood flow. Many of the patients literally sit upon their heels for extended periods. In general, radiological methods are of much greater aid in diagnosis than is physical examination, although both are important. It is obvious that the severity of cyanosis and disability will depend to a considerable extent on the degree of

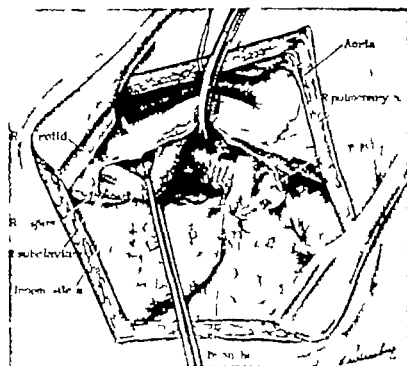


Fig. 8. Showing the exposure of the innominate artery and its branches, the right subclavian and the right common carotid artery. Exposure is accomplished by dissecting posterior to the superior vena cava. The innominate artery usually rises from the aorta slightly to the left of the trachea. These vessels are dissected free of the adjacent tissues and adequate mobilization obtained. If thyroidea ima branch is present it is ligated and divided.

pulmonic stenosis and overriding of the aorta. Some patients with severe disability may have little polycythemia and cyanosis.

#### TECHNIQUE OF OPERATION

Possible means by which the flow of blood to the lungs may be increased in the presence of the tetralogy of Fallot and similar conditions include an attack on the stenotic area itself or the use of a shunt operation in which the stenosis is by passed. The stenotic area is usually in the pulmonary conus of the right ventricle rather than in the pulmonary valve area, and excision or incision would be not only dangerous but probably would be followed by a recurrence of the stenosis at a later date. Because of this probability the better procedure would appear to be that in which some of the improperly oxygenated blood in the aorta is shunted to the lungs. This is possible because of the proximity of the thoracic aorta and its branches to the two major

branches of the pulmonary artery. It may be accomplished by anastomosing the aorta or one of the branches of the arch of the aorta to one of the two pulmonary arteries. Fortunately the pressure in the aorta and its branches is high and the pressure in the pulmonary artery and its branches is low and a good anastomosis will result in the passage of a large quantity of improperly oxygenated blood from the aorta through the lungs. An anastomosis which is properly performed between blood vessels of good caliber will almost certainly remain patent.

My associates and I have performed the following anastomoses between the systemic and pulmonary arteries in patients: (1) the proximal end of the right or left subclavian artery and the side of the right or left pulmonary artery; (2) the proximal end of the right or left subclavian artery and the distal end of the right or left pulmonary artery; (3) the proximal end of the carotid or innominate artery

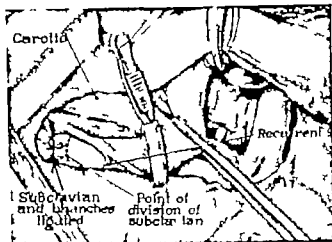


Fig. 9. The relationship of the vagus and recurrent laryngeal nerves to the subclavian artery is shown. In order to obtain a long length of the subclavian artery the ligatures are usually placed just beyond the initial branching. In the majority of cases the first branch of the subclavian is the vertebral artery. There is less danger of slipping of the ligatures if it and the subclavian are ligated separately. The subclavian artery is occluded proximally with a rubber-shod arterial clamp. The tips of the clamp are tied together in order to prevent slipping. The subclavian artery is then cut across proximal to the ligatures at its distal end.

and the side or distal end of the right or left pulmonary artery and (4) the side of the aorta and the side of one of the pulmonary arteries. The type of anastomosis which is chosen should be suited to the case in question. In general we prefer an anastomosis between the proximal end of the subclavian branch of the innominate artery and the side of one of the pulmonary arteries. The reason for this is that the subclavian branch of the innominate artery when transposed makes a much more satisfactory angle with its parent vessel than is present when the subclavian branch of the aorta is used. Since this is the method which we prefer in the majority of instances the steps of the procedure will be described and illustrated.

The side on which the aorta descends is determined preoperatively by the method of Bedford and Parkinson. If the aorta descends on the left the innominate artery is on the right; if the aorta descends on the right the innominate is on the left. Since we are desirous in most cases (with exceptions to be noted later) of using the subclavian branch of the innominate the incision in the chest is made on the side opposite to that on which the aorta lies. This means in the majority of cases in

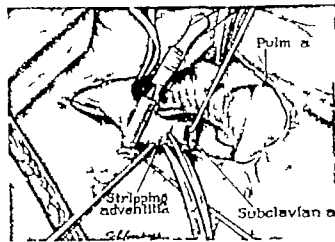


Fig. 10. The adventitia is removed from the end of the subclavian artery.

our experience that the incision is made on the right. With the patient lying on his back and with the side to be operated upon somewhat elevated an incision is made extending from the sternal margin to the midaxillary line. In the female the incision is made below the breast. Whereas formerly the incision into the pleural cavity was made through the third interspace it is now usually made through the second interspace except in infants when the third is chosen. The higher incision results in less interference with inflation of the lung and gives better exposure of the apex of the pleural cavity. A costal cartilage may or may not be

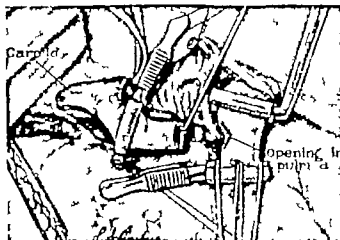


Fig. 11. The right pulmonary artery is occluded proximally by an especially devised rubber-shod clamp which has a long handle and which operates by a screw mechanism. Distal occlusion is produced by an ordinary rubber-shod arterial clamp. A transverse opening is made on the upper surface of the pulmonary artery. This opening should be a little larger than the end of the subclavian artery. If the pulmonary artery is quite small it may be advisable to make the opening into it in a longitudinal direction.

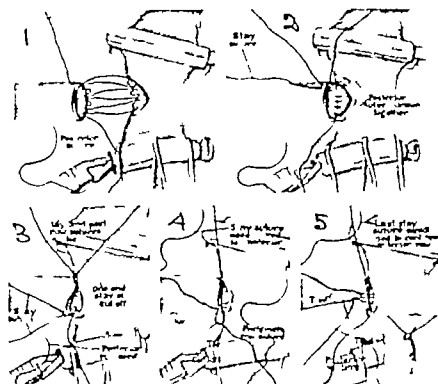


Fig 9 Showing the steps of the anastomosis, reading from left to right, first horse and then below Deknatel sutures \ ooooo re used. The type of suture is an everting continuous one which includes the entire thickness of the wall of the artery. The intima is turned out and the space separating each bit in the vessel approximates 1 millimeter. The posterior row is placed before it is drawn taut. The ends are then tied by stay sutures. The anterior row is interrupted at one point. The anterior row is pulled tight as it is placed. Unlike the diagrams, very little silk is visible on the interior of the blood vessels.

divided. The following 8 illustrations (Figs 6-13) picture the procedure when an anastomosis is performed between the proximal end of the subclavian branch of the innominate artery and the side of the right pulmonary artery. The position of the patient on the operating table and the location of the right pulmonary artery area and the axillary vein are shown in Figure 6. The next figure (Fig 7) represents the same region after ligation and division of the axillary vein and exposure of the right pulmonary artery. After exposure of the right pulmonary artery dissection is carried out just beneath the superior vena cava and the innominate artery together with its branches, the right common carotid artery and the right subclavian artery is exposed (Fig 8). The right vagus and recurrent laryngeal nerves mark the position of the right subclavian ar-

tery. The right subclavian artery is occluded proximally with a rubber-shod clamp; it is ligated distally at its point of division and is cut across proximal to the ligature (Fig 9). The adventitia is then removed from the end of the subclavian artery (Fig 10). At this stage the operation is usually interrupted for several minutes and the lung is inflated. Following this rest period the right pulmonary artery is occluded proximally with a rubber-shod instrument with a long handle and is occluded distally with a bulldog clamp. A transverse opening slightly larger than the end of the systemic vessel is made between the points of occlusion on the upper surface of the pulmonary artery (Fig 11). An anastomosis is then performed between the end of the subclavian artery and the side of the pulmonary artery by the use of No. 00000 Deknatel su-

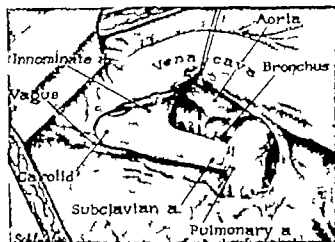


Fig. 13.

Fig. 13. Showing the completed anastomosis. The constricting devices were removed first from the pulmonary artery and subsequently from the subclavian artery. The transposed subclavian artery makes an excellent angle with its parent vessel, the innominate artery.

Fig. 14. Showing an end-to-side anastomosis between the left subclavian artery (branch of aorta) and the side of the left pulmonary artery. In contrast to the use of the subclavian branch of the innominate this method has the disadvantage that rather sharp angulation of the subclavian may occur at the point at which the subclavian arises from the aorta. On the other hand, the anastomosis is easier to perform and usually functions satisfactorily. When the lung is inflated at the completion of the procedure the angulation is lessened. Furthermore, one may elevate the position of the pulmonary artery slightly by suturing the visceral pleura of the hilus of the upper part of the lung to the mediastinal pleura. We use this method in most patients over the age of 12 because difficulty may be encountered in approximating the subclavian branch of the innominate artery to the pulmonary artery. The left pulmonary artery lies at a slightly higher level than the right.

Fig. 15. Showing an end-to-end anastomosis between the proximal end of the right subclavian artery and the distal end of the right pulmonary artery. The most frequent indications for this type are (1) a very small pulmonary artery in which an end-to-side union would be less satisfactory and (2) a short subclavian artery which it is difficult or impossible to approximate to the side of the pulmonary artery. A good end-to-end anastomosis is prefer-

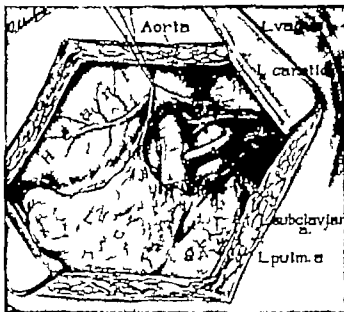


Fig. 14.

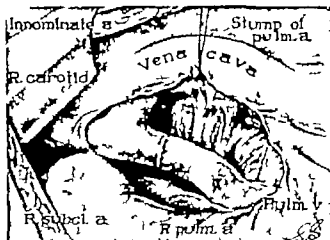


Fig. 15

able to an imperfectly performed end-to-side union. In the performance of the anastomosis, three or four guide or stay sutures are placed and these are connected by continuous sutures which evert the intima.

tures. The suture is one which everts the intima of the vessels. The procedure is rendered easier if the posterior suture line is placed before it is drawn taut (Fig. 12). After it has been drawn together the two ends of the posterior row are anchored to stay sutures placed in mattress fashion. The anterior row of sutures which may be interrupted at one or more points is then placed and tied. After the anastomosis has been completed the various constricting devices are removed (Fig. 13).

It should be noted that the transposed subclavian artery makes an angle of about 90 degrees with the innominate artery and that

there is no impediment to the flow of blood. Following the establishment of the anastomosis the color of the patient usually improves strikingly and a continuous thrill can be felt in the pulmonary artery. If one uses care and patience in freeing long lengths of the pulmonary artery and the innominate and its branches one will rarely have difficulty in performing a satisfactory anastomosis between the subclavian branch of the innominate artery and the pulmonary artery in patients between the ages of 2 and 13 years.

It has been stated previously that the innominate artery arises on the left when the

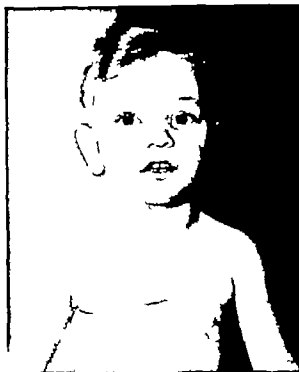


Fig. 6 Showing a child in whom an anastomosis between the proximal end of the right subclavian artery and the side of the right pulmonary artery was performed 7 months after an anastomosis between the proximal end of the left subclavian and the distal end of the left pulmonary artery. It was gratifying to note that the child withstood temporary occlusion of the right pulmonary artery after the left pulmonary had been divided. This patient is doing very nicely.

aorta descends on the right and that the position can be determined preoperatively. Under such circumstances the incision is made on the left and the subclavian branch of the innominate artery is used. This operation is usually easier than a similar procedure on the right.

In the first operation which I performed for pulmonic stenosis, an anastomosis was made between the left subclavian artery which arose directly from the aorta, and the side of the left pulmonary artery. Although such an anastomosis generally functions properly the altered position of the subclavian artery usually results in rather sharp angulation at the point at which the artery arises from the aorta. The nature of the angulation is shown in a slightly exaggerated form in Figure 14. I wish to emphasize the point that such an anastomosis usually functions satisfactorily and that this procedure is usually easier technically

than a union between the right subclavian branch of the innominate and the side of the right pulmonary artery. This is because the dissection and exposure are easier and the left pulmonary artery occupies a slightly higher position than the right. In fact, we generally perform an anastomosis between the left subclavian and the left pulmonary artery in patients who are older than 12 years of age and who have attained most of their growth and in whom there may be difficulty in approximating the right subclavian to the right pulmonary artery. This is done despite the fact that it is not as ideal a procedure as the use of the right subclavian branch of the innominate. In expressing a preference for the use of the subclavian branch of the innominate over that of the subclavian which arises directly from the aorta I realize that Murray Paine and Varco, Holman, and others generally utilize the subclavian artery which arises directly from the aorta and that they are obtaining excellent results.

In the earlier phases of this work we frequently thought it necessary or advisable to use the innominate or the carotid artery for the anastomosis for the reason that the subclavian artery was regarded as too short or too small. With added experience it has been found that a short subclavian artery can generally be used if the pulmonary artery and the systemic vessel in question are dissected free of the surrounding tissues and adequately mobilized. In mobilizing the right or left pulmonary artery the dissection should be extended well beyond the initial point of branching. If one can perform the anastomosis by using the subclavian branch of the innominate, there will not be too much tension on the suture line postoperatively. Inflation of the lung after the anastomosis is completed causes it to rise somewhat in the chest and reduces tension. In other words, the limiting factor in an anastomosis is the difficulty in approximating the structures while the union is being performed and not the fear of postoperative separation of the suture line. In some of the earlier operations we frequently underestimated the size of the subclavian artery and used another vessel when the subclavian would probably have sufficed. When tension is made on the

undivided subclavian artery, it is narrowed at the point at which the subclavian artery and recurrent laryngeal nerve pass over it and appears smaller than is the actual case. There is however an occasional patient in whom we are unable to anastomose the subclavian branch of the innominate to the side of the pulmonary artery despite the employment of various maneuvers. Under such circumstances one may divide the pulmonary artery and do an anastomosis between its distal end and the subclavian artery or one may choose the innominate or the carotid artery for union to the side of the pulmonary artery. If the pulmonary artery is not more than two or three times the size of the subclavian artery I prefer the use of this vessel and the end to-end anastomosis because of the fear of cerebral complications when using the carotid or the innominate artery. The results following a good end to-end anastomosis (Fig 15) are almost as satisfactory as those following an end to-side union. If the pulmonary artery is fairly large or if for other reasons it is impossible or inadvisable to use the subclavian artery in an end to-end or end to-side anastomosis I think that one is warranted in using the innominate or the carotid artery despite the added risk. A long length of the carotid artery is readily available. In most instances in which the carotid has been used the subclavian had already been ligated. In two operations performed by Dr Longmire it was determined at the outset that it would probably be impossible to use the subclavian artery and the carotid was ligated without disturbing the subclavian artery. It would seem that preservation of the subclavian and its vertebral branch would reduce the chances of cerebral complications in connection with ligation of the carotid artery.

If the right or left pulmonary artery is definitely smaller than the subclavian artery it is advisable to divide the pulmonary artery as near its point of origin from the main vessel as possible and to perform an anastomosis between its distal end and the end of the subclavian artery. If one attempts an end to-side procedure and fails one has lost valuable length of the pulmonary artery. Furthermore a good end to-end anastomosis is to be

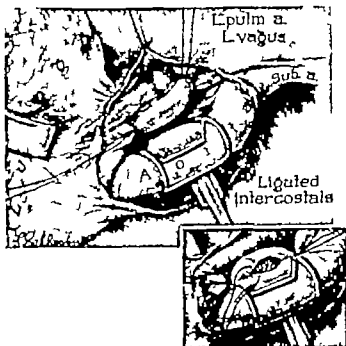


Fig 17 Showing the method of Potts, Smith, and Gibson of performing an anastomosis between the side of the aorta and the side of the left pulmonary artery. This ingenious clamp allows the anastomosis to be performed when the aorta is only partially occluded, thereby obviating the likelihood of paralysis of the legs. The union of intimal surfaces is not as exact as when a branch of the aorta is used and one should take care not to make the opening too large. It is my opinion that this method is particularly valuable in the treatment of infants with pulmonic stenosis in whom the subclavian artery is too small to conduct an adequate quantity of blood to the lungs. This method is difficult to use if the aorta descends on the right.

preferred to a fair end to-side union. As was stated previously the results following an end to-end anastomosis are usually good. I formerly thought that it would be impossible to do a second operation on the opposite side should such become necessary if the original operation had consisted of an end to-end anastomosis. That this is not true is proved by a recent case in which an anastomosis between the end of the right subclavian and the side of the right pulmonary artery was performed 27 months after an operation on the left side in which the end of the left subclavian was anastomosed to the end of the left pulmonary artery. At the time of the first operation the child was 8 months old, the action of the heart was very poor and the left pulmonary artery was small. Some improvement followed the first operation but it was not adequate. At the second operation the patient's circulatory system withstood temporary occlusion of the



right pulmonary artery despite the fact that the left had been divided and the postoperative improvement is dramatic. A photograph of the child after the second operation is given in Figure 16.

In our initial publication on the surgical treatment of pulmonic stenosis Dr. Taussig and I (4) enumerated a number of methods by which the blood flow to the lungs could be increased. Among these was an operation in which the side of the aorta is anastomosed to the side of the left pulmonary artery. It was stated: "The third possible operative procedure is concerned with an anastomosis of the side of the aorta to the side of the left pulmonary artery. That such a procedure is possible in dogs has been shown by Leeds in his studies on patent ductus arteriosus. We considered the use of this method in our patients but were discouraged by the experience of Blalock and Park in studies on experimental coarctation of the aorta. We were fearful of causing a paralysis of the lower extremities and hence did not use this method with our patients. Another difficulty associated with the use of the aorta is that its walls are thick and rather friable and it is difficult to obtain an accurate approximation of the intimal surfaces. I think that the last objection to the use of the aorta still holds, but the danger of paralysis has been largely removed by Potts, Smith and Gibson by the development of an ingenious clamp with which the aorta can be partially occluded while a side-to-side anastomosis to the left pulmonary artery is being performed. The employment of this clamp is illustrated in Figure 17. Although I realize that the Potts clamp may be utilized in performing anastomoses in patients of all ages, it is my opinion that its greatest field of usefulness is in infants in whom the subclavian artery is very small. It is my impression and it is only an impression that an aortic-pulmonary artery anastomosis places a greater strain upon the heart than a communication of the same size between a branch of the aorta and the pulmonary artery. There are many cases in which the pulmonary artery is too small for a satisfactory anastomosis with the side of the thick-walled aorta."

use of the aorta is usually accompanied sacrifice of a larger number of collateral

arterial pathways to the lungs than is the case when one of the aortic branches is employed. Even though one prefers to utilize the subclavian artery everyone who is doing this type of surgery should have the Potts clamp available. For example if one makes an incision on the left in an adult with the idea of using the subclavian branch of the aorta, one may decide to do an aortic anastomosis if for some reason the subclavian artery is unsatisfactory.

The principle underlying all of the operative procedures which have been mentioned is the same namely by passing the point of stenosis in the pulmonary artery and allowing poorly oxygenated blood in the aorta to pass through the lungs. The surgeon performing this type of work should be thoroughly familiar with the anatomy of the region, should be able to do end-to-side, end-to-end, and side-to-side anastomoses and should be able to use the subclavian artery, the carotid artery, the innominate artery or the aorta according to indications. The same procedure does not fit all cases. As I stated previously the subclavian artery may be too small or too short. The aorta is not suitable if the pulmonary artery is very small in size. Obviously under such conditions one could perform a better anastomosis by using a smaller, thinner-walled vessel such as the subclavian artery.

There is always a systemic vessel which can be used for the anastomosis. The limiting factor is the pulmonary artery. If there is no pulmonary artery or if the artery is diminutive in size, one is obviously defeated. The size of the aorta and its branches varies greatly. Some small children have large systemic arteries when this is the case the pulmonary artery is apt to be small.

A later section of this paper will deal with anomalies of the blood vessels. At this point it should be emphasized again that one should know preoperatively the position of the aorta for this is of importance in determining the side on which the operation is performed. If the aorta descends on the right and one wishes to use the subclavian branch of the innominate the incision is made on the left. If the aorta descends on the right and one wishes to use the aorta, obviously the incision is made on the right.

There are several reasons for our preference not to operate upon infants under the age of 2 and for the present policy of not advising operation in infants if it is thought that there is a 50 per cent chance that the infant will survive to be 2 years of age or older. Among the reasons are the facts that it is more difficult to be certain of the diagnosis in infants that the operative mortality is higher and that the anastomosis has by necessity to be a rather small one. Even though the aorta is used, one does not dare to make a large communication between the two vessels in infants because of the danger of causing heart failure. It is not known whether the anastomosis increases in size with the growth of the vessels. It seems likely that some of the patients operated upon in infancy will have to have a second operation at a later date.

The present ideas in regard to the type of operation as related to the age and size of the patient are roughly as follows

A. Patients under 2 years of age.

- 1 Do not operate if the chances of survival to 2 years of age are 50 per cent or better
- 2 Make the incision on the side on which the aorta descends. Use the subclavian artery if it appears large enough. If not, perform side-to-side anastomosis between the aorta and the pulmonary artery

B. Patients 2 years to 12 years of age.

- 1 Make the incision on the side opposite to that on which the aorta descends. The preferred anastomosis is between the subclavian branch of the innominate and the side of the pulmonary artery
- 2 If the pulmonary artery is very small, do an end-to-end anastomosis between the subclavian artery and the distal end of the pulmonary artery

C. Patients more than 12 years of age or more than 5 feet in height or both 12 years of age and 5 feet in height.

- 1 If the aorta descends on the left, make the incision on the left. Perform by preference an anastomosis between the subclavian branch of the aorta and the side of the left pulmonary artery. If this is impossible and if there is not too great discrepancy in the sizes of the subclavian and pulmonary arteries perform an end-to-end anastomosis. An alternative method is an anastomosis between the side of the aorta and the side of the left pulmonary artery
- 2 If the aorta descends on the right, make the incision on the left and use the subclavian branch of the innominate artery for the anas-

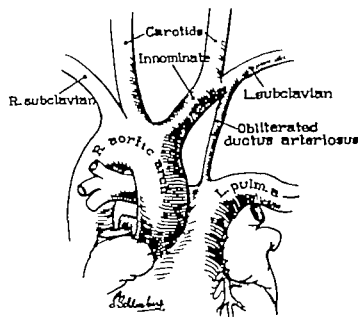


Fig. 18 Showing a right aortic arch with an aorta which descends on the right. The position of the descending aorta is of importance from a surgical standpoint in that it determines the side on which one makes the incision. The innominate arises on the side opposite to that on which the aorta descends. In most of the cases in which the aorta descends on the right there is an obliterated ductus arteriosus which connects the pulmonary artery with the first portion of the left subclavian artery

tomosis. This blood vessel is usually a long one and furthermore the left pulmonary artery is usually at a higher level in the chest than the right pulmonary artery

#### ANOMALIES OF THE BLOOD VESSELS

This description of blood vessel anomalies is by no means all inclusive. It is simply a brief account of some of the anomalies most of which have been observed in the course of operations on our patients.

**Right aortic arch** If the aorta arches to the right and descends upon the right, the condition is termed a right aortic arch. The three major vessels which arise from the arch of the aorta are the mirror image of normal; that is the innominate artery arises first and passes toward the left, the right common carotid arises next and the right subclavian artery last. The condition places no undue strain on the heart and is usually of importance only in that it may influence the side upon which the operation for pulmonic stenosis or atresia is performed. By and large the easiest anastomoses which we have performed are in patients with a right aortic arch because the left subclavian branch of the innominate is usually a

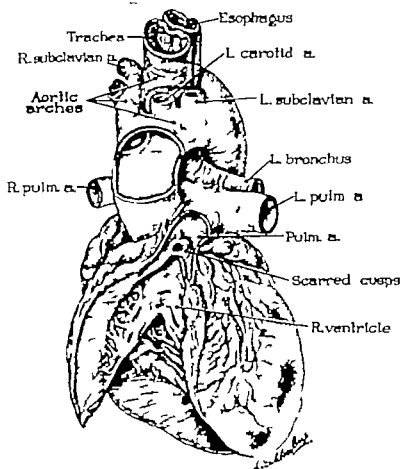


Fig. 9. Showing double aortic arch or aortic ring. The patient died suddenly on the fourteenth postoperative day after the creation of an artificial ductus for pulmonic stenosis.

long vessel and can be approximated to the left pulmonary artery without difficulty. As stated previously the presence of a right aortic arch can be determined by the method of Bedford and Parkinson. Dr. Taussig and her associates have been in error as to the position of the aorta in only 2 or 3 of our cases.

A right aortic arch occurs so often that perhaps it should not be regarded as an anomaly. It has been found in 144 of the 610 cyanotic patients upon whom we have operated. It has been surprising that the incidence is so high in view of the fact that the late Dr. Maude Abbott found only 35 cases in an analysis of autopsies on 1,000 cases of congenital heart disease. In 14 of these the right aortic arch was the "primary" lesion whereas in 21 cases it was associated with other defects.

In approximately three-fourths of the patients with a right aortic arch upon whom we have operated there has been an obliterated ductus arteriosus connecting the first part of the left subclavian branch of the innominate to the pulmonary artery. This is a long fibrous structure which in some instances has a small lumen at either the systemic or the pulmonic end. This has been a surprising observation in view of the belief that in a right aortic arch the sixth right branchial arch distal to the pulmonary artery persists as the ductus arteriosus. The usual finding in our cases is shown in Figure 18. In our experience with the right aortic arch the ductus has not always been on the left and furthermore Dr. John Jones has operated upon a patent ductus on the right in a patient with a right aortic arch.

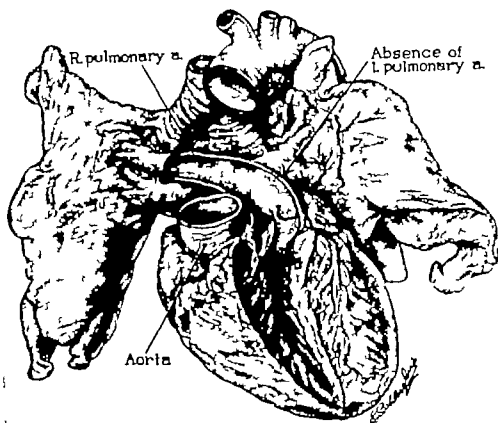


Fig. 20. Autopsy specimen showing a pulmonary artery to only one of the lungs. Such a condition should be suspected as a result of preoperative studies and the observations at the time of operation.

In some instances the aorta arches to the right but then turns sharply to the left and descends on the left. This is known as a right aortic arch with a left descending aorta. Under such conditions the aorta lies behind the esophagus and is called a retro-esophageal aorta. The point of origin of the arteries from the arch is variable. In some cases the left subclavian artery arises from the descending aorta.

A patient was operated upon recently who had the rare combination of a left aortic arch, a retro-esophageal aorta, and a right descending aorta. This case is being reported by Dr R. N. Paul.

In a patient with dextrocardia the aorta may descend on the right or the left. This statement is true whether there is or is not a complete situs inversus. Dr Taussig has found that a left aortic arch occurs in a high percentage of patients with dextrocardia. From the surgical standpoint the important fact to remember is that the innominate artery arises on the right when the aorta descends on

the left and on the left when the aorta descends on the right. Furthermore the prognosis should be very guarded in patients with dextrocardia particularly if there is not situs inversus. Additional malformations of the heart and blood vessels are likely to be present.

It should be emphasized that these observations on the aortic arch are largely of academic interest except as the position influences the site from which the large vessels arise and hence the side on which the incision is made. It is true that patients with abnormal position of the great vessels may have dysphagia lusoria but this was not encountered in this series of patients.

**Double aortic arch.** A double aortic arch or aortic ring is a rare malformation. The aorta arches to the right and descends on the left. It occurs as a result of the persistence of both the right and the left fourth aortic arches as functioning tubes. Thus the double aorta encircles the trachea and the esophagus. The origin of the great vessels from the double arch is variable.

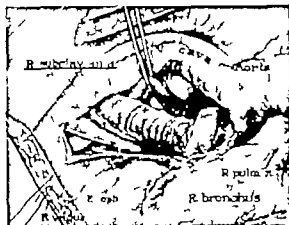


Fig. 18. Showing the right subclavian in a position posterior to the trachea and esophagus. The position can be determined by inspection and palpation. Furthermore, the fact that the vagus nerve does not pass across the subclavian artery leads one to suspect an abnormal position.



Fig. 19. Showing the transposed position of the retro-esophageal subclavian artery. In most instances in which this anomaly is encountered the subclavian artery has not been brought out anterior to the trachea and esophagus.

I am aware of only one patient with a double aortic arch in association with the tetralogy of Fallot upon whom I have operated, and the double aortic arch was not recognized at the time of operation. An anastomosis between the end of the right subclavian artery and the side of the right pulmonary artery was performed on this 20 year old girl from France. She did well in the early postoperative period but died suddenly of what was thought to be a cerebral embolus on the fourteenth postoperative day. At autopsy a large thrombus in the left ventricle was seen. The double

aortic arch is shown in Figure 19. It is very likely that an aortic ring was present in a few of the other patients in whom an artificial ductus was created.

*Single pulmonary artery.* Observations at the time of operation or autopsy in 9 of the patients indicate that there was a pulmonary artery to only one of the two lungs. Such a finding should be suspected in preoperative studies in which the vascular markings on the one side are less pronounced than those on the opposite side. Furthermore the condition should be suspected at the time of operation

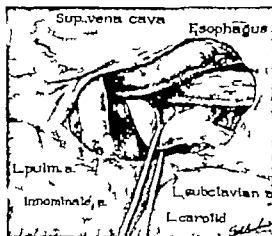


Fig. 20. Showing retro-esophageal innominate artery on the left.

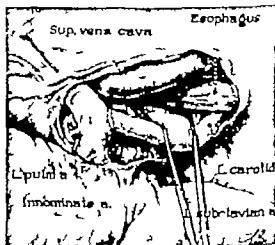


Fig. 21. Anastomosis between subclavian branch of a retro-esophageal innominate and left pulmonary artery.

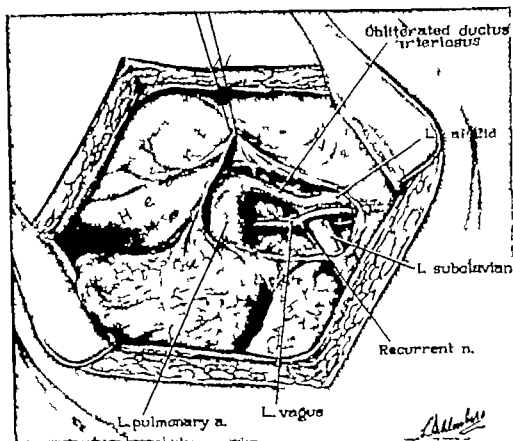


Fig. 25. The condition in a patient who had a right aortic arch and in whom the incision was made on the left is shown. In approximately the position in which the innominate artery should have been located there was an obliterated cord which connected the junction of the left subclavian and left carotid arteries with the pulmonary artery. Palpable arterial pulsations were present in the subclavian and carotid arteries.

if the action of the heart becomes impaired during temporary occlusion of the right or left pulmonary artery or if the pressure in the pulmonary artery rises noticeably during the occlusion period. If the collateral circulation to the lungs is well developed a patient with a single pulmonary artery may withstand occlusion of this vessel for a sufficiently long time to allow for the performance of an anastomosis. It is doubtful however if the risk is warranted if the presence of a single pulmonary artery is strongly suspected. The condition seen at autopsy in a patient who had a single pulmonary artery is shown in Figure 20.

**Retro-esophageal subclavian artery** This anomaly has been observed in 26 patients. In 12 of these the operation was being performed on the right side. In none of these was there a history of difficulty in swallowing. In a number of the patients an abnormality in position of the subclavian artery was suspected preoperatively because of a slight de-

formity of the esophagus as observed on the x ray film after the swallowing of barium. In most of the cases in which a retro-esophageal subclavian artery was found the anastomosis

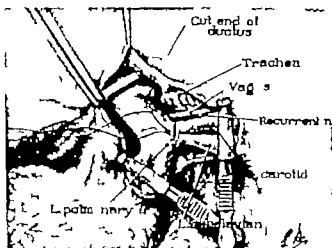


Fig. 26. Showing an anastomosis between the junction of the left subclavian and carotid arteries (Fig. 25) and the left pulmonary artery. The patient improved strikingly after operation.

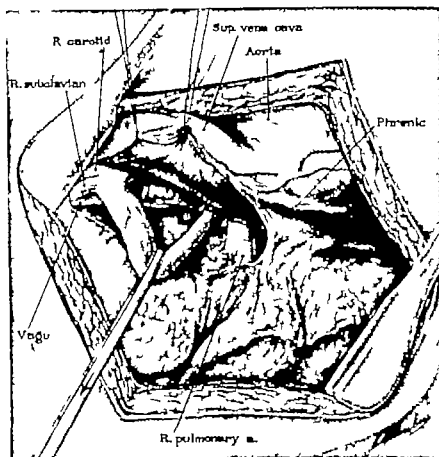


Fig. 27 Showing a large unidentified vessel on the right side which was thought to be ductus arteriosus. It arose from the innominate and was almost as large as the innominate. It became progressively smaller as it approached the pulmonary artery area. The flow of blood was from the innominate end. Patency of the opposite end was not demonstrated.

between it and the pulmonary artery was performed without altering essentially the position of the subclavian. In several instances the right subclavian artery was delivered to the left of the right bronchus and the esophagus after it had been divided distally and the anastomosis was performed anterior to these structures. Diagrams of the preoperative and postoperative positions in one of these patients are shown in Figures 21 and 22. In any case the retro-esophageal location of a subclavian artery is not a deterrent to the performance of a satisfactory anastomosis. The wall of a retro-esophageal subclavian artery is thinner than that of the same vessel in a normal position.

**Retro-esophageal innominate artery.** A retro-esophageal innominate artery has been ob-

served in only one of our patients. The abnormal position of this blood vessel presented no unusual difficulties in the creation of an artificial ductus arteriosus. The condition at the time of operation before and after the performance of the anastomosis is shown in Figures 23 and 24.

**Absence of innominate artery.** The four great vessels, the two subclavian arteries and the two common carotid arteries may arise directly from the aorta in which case the innominate artery is absent. The opposite extreme is found in cases in which both common carotid arteries as well as one of the subclavian arteries arise from the innominate. The identity of the great vessels must be determined with care at the time of operation and the surgeon should ask the anesthetist to ascertain



Fig. 28 Anastomosis between the unidentified vessel shown in the previous figure (probably a ductus arteriosus) and the right pulmonary artery

the effect on the peripheral pulse of temporary occlusion of the blood vessel under consideration for ligation. In this way the unnecessary use of one of the carotid arteries may be avoided.

An unusual anomaly in which the presence of an innominate artery was not demonstrated is shown in Figure 25. A band of fibrous tissue without a lumen connected the junction of the left common carotid artery and the left subclavian artery with the pulmonary artery. This patient had a right aortic arch; hence the innominate artery should have been on the left. Pulsations were palpable in the carotid and subclavian arteries but the origin of the vessels was not determined. The performance

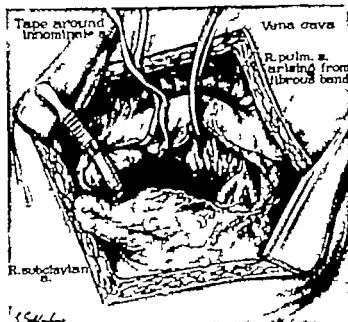


Fig. 29 Showing a functional truncus arteriosus with a blind right pulmonary artery. Subsequent autopsy did not disclose a pulmonary artery on the left. The circulation to the lungs was entirely through collateral arterial channels.

of an anastomosis between the junction of these arteries and the left pulmonary artery resulted in definite improvement in the patient (Fig. 26).

**Unusual ductus arteriosus.** It was the consensus among us that the large blood vessel shown in Figure 27 was a ductus arteriosus which was obviously patent at the innominate end and which may or may not have been patent at the opposite end. The innominate

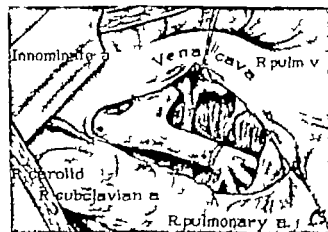


Fig. 30 Showing an anastomosis between the right subclavian artery and the patent distal end of the pulmonary artery shown in the previous figure. The patient, who died as the anastomosis was being completed, should have been greatly improved if the operation had been tolerated.

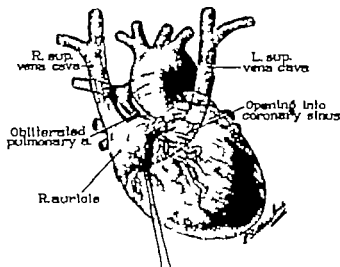


Fig. 31 Showing the presence of bilateral superior venae cavae, a frequent anomaly. The entrance of the left superior vena cava into the heart is variable.



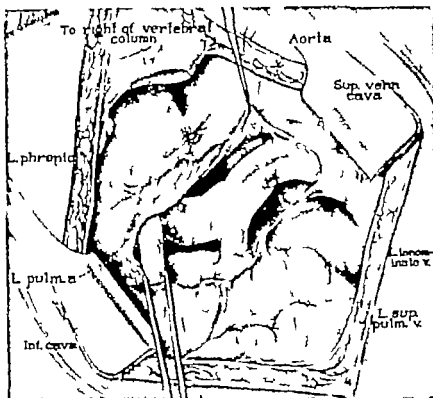


Fig. 32. This interesting anomaly shows the superior and inferior venae cavae on the left and the left superior pulmonary vein entered approximately at the junction of these vessels.

end of this vessel was only slightly smaller than the innominate artery itself and it became progressively smaller as it approached the region of the base of the heart. The pulsating stream of blood originated from the

innominate end of the vessel. Even though we could not be certain as to the point of attachment or the lack of patency of the opposite end of the vessel it was cut across and an anastomosis to the right pulmonary artery was performed (Fig. 28). The patient showed striking improvement following the operation.

**Functional truncus arteriosus with blind pulmonary artery.** Several patients have been operated upon in whom the pulmonary artery did not connect with the heart or the aorta. The circulation to the lungs was by way of collateral vessels usually bronchial arteries. An example of this condition is illustrated in Figure 29. An end-to-end anastomosis was performed between the right pulmonary artery and the right subclavian artery but unfortunately the heart's action ceased suddenly just as the union was completed (Fig. 30). Autopsy examination showed that there was no communication on either side between the pulmonary artery and the heart or aorta and

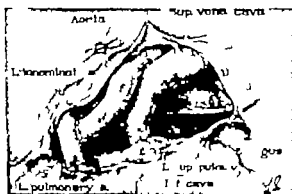


Fig. 33. Showing an anastomosis between the left innominate artery and the left pulmonary artery in the presence of the anomaly shown in the previous figure. Under such conditions the transposed artery should not be placed in such position that it will press upon the vein.

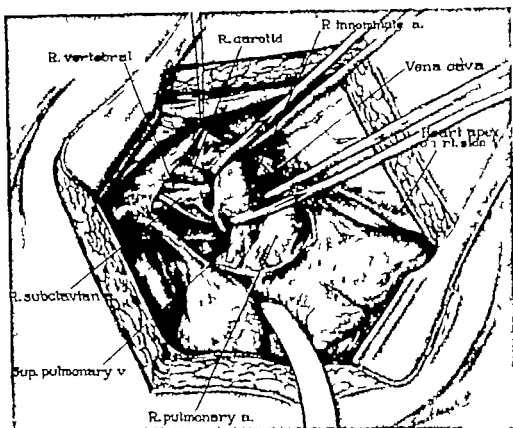


Fig. 34. Showing an anomalous position of the superior vena cava. The superior pulmonary vein entered the superior vena cava.

that the circulation to the lungs was through collateral vessels. The patient should have been greatly improved if the operative procedure had been tolerated.

**Bilateral superior venae cavae.** The presence of bilateral superior venae cavae is not a rare anomaly. With the increased use of venography a surprisingly large number of cases have been discovered. Since exploratory thoracotomy exposes the contents of only one pleural cavity, it is difficult to make the diagnosis by operation alone. It is true, however, that a left superior vena cava has been observed in a number of the patients in whom the incision was made on the left. When bilateral superior venae cavae are present, both veins may open into the right auricle or one may enter the right and the other the left auricle or one may enter the right auricle and the other the coronary sinus. An illustration depicting the entrance of the right superior cava into the right auricle and the left into the coronary sinus is shown in Figure 31.

**Other anomalies of systemic veins.** Other anomalies range from those in which both the

superior and the inferior venae cavae enter the left auricle to minor variations in position of the various vessels. The presence of both the superior and the inferior venae cavae on the left as observed at the time of operation is shown in Figure 32. The site of entrance into the heart was not determined. It was noted that the left superior pulmonary vein entered these vessels. The type of arterial anastomosis which was performed is shown in Figure 33. It is important to place the systemic artery which is used for the shunt in such position that it will not press on the superior or inferior vena cava.

A peculiar position of the superior vena cava as observed in an operation on the right side is shown in Figure 34. The superior pulmonary vein emptied into this vessel. The anastomosis between the subclavian artery and the pulmonary artery is shown in Figure 35.

An anastomosis on the right side was made more difficult in a case in which the left innominate vein passed posterior to the innominate artery and almost circumscribed it (Fig

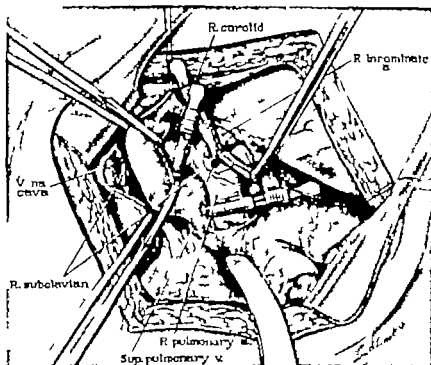


Fig. 35. Showing the anastomosis between the right subclavian artery and the right pulmonary artery in the presence of the anomalous position of the superior vena cava as depicted in Figure 34.

36) The completed anastomosis is depicted in Figure 37

**Anomalies of pulmonary veins.** Some or all of the pulmonary veins may drain into the right auricle or its tributaries. Two such cases are shown in drawings in the preceding section. Despite the fact that no attempt was made to alter the site of the drainage in these cases at the time that an artificial ductus arteriosus was created the patients have improved greatly.

Brody, Brantigan and others have reported similar anomalies of the pulmonary veins and have reviewed the literature. With further improvement in diagnostic methods and surgical technique some of these anomalies can probably be treated successfully by operation.

#### TREATMENT AND RESULTS

The preoperative and postoperative care of most of the patients is not very difficult or complicated. Digitalis is recommended before operation for patients in whom the cardiac output is low. The removal of the venous

section is seldom if ever indicated. Care should be exercised in the preoperative period to see that the patient does not become dehydrated because of the possibility that cerebral thrombosis may occur. A child should receive at least 1,600 cubic centimeters of fluid per diem and an adult at least 2,200 cubic centimeters per diem. The administration of penicillin should be begun before or shortly after the operative procedure.

The total quantity of fluids administered during the operation should equal approximately the loss of blood during the procedure. Unless blood loss is excessive the fluid is given in the form of plasma. If severe bleeding occurs, whole blood is administered. If the pulse rate should become alarmingly slow additional atropine is given.

All patients are placed in an oxygen tent on being returned to their rooms. Venesection is rarely performed. Aspiration of the pleural cavity on one or more occasions is performed in at least half of the cases. The administration of whole blood is indicated if a large accumula-

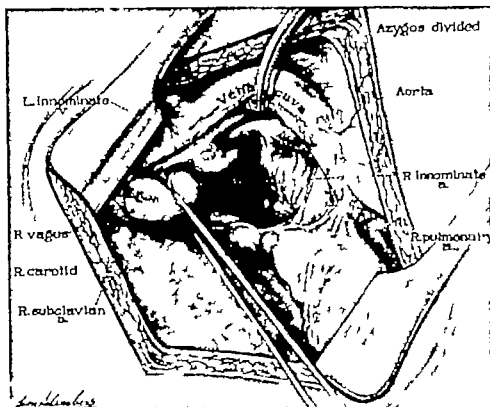


Fig. 36 Showing an anomalous position of the left innominate vein in which it lies posterior to the innominate artery

tion of blood in the pleural cavity occurs. The problem as to the quantity of fluid other than blood which should be given is a delicate one. The quantity should be sufficient to reduce the likelihood of cerebral and anastomotic thrombosis and should not be sufficient to cause pulmonary edema and heart failure. In general the total fluid intake each 24 hours in the early postoperative period should be 700 to 900 cubic centimeters in infants, 1,000 to 1,400 cubic centimeters in children and 1,800 to 2,200 cubic centimeters in adults. If evidence of cerebral thrombosis or occlusion of the anastomosis appears the administration of heparin is indicated. It is important to bear in mind that these patients need rest in the postoperative period and that they may be overtreated as well as undertreated.

My associates and I have operated upon 610 cyanotic patients who were believed as a result of preoperative studies by Dr. Taussig, Dr. Bing, and others to have an inadequate flow of blood to the lungs. With the exception of 15 patients who were operated upon in Guy's Hospital in London and Hôpital Broussais in Paris, the operations were performed in

the Johns Hopkins Hospital. A second anastomosis has been carried out on several of the patients. The total number of patients who have died is 108, an overall mortality rate of 17.7 per cent. Twenty-seven of the deaths occurred during the operation, 68 in the postoperative period, and 13 after discharge from

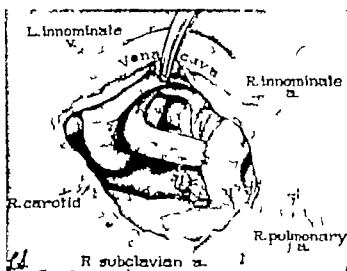


Fig. 37 Showing the relationship between the subclavian-pulmonary arterial anastomosis and the innominate vein as demonstrated in Figure 36

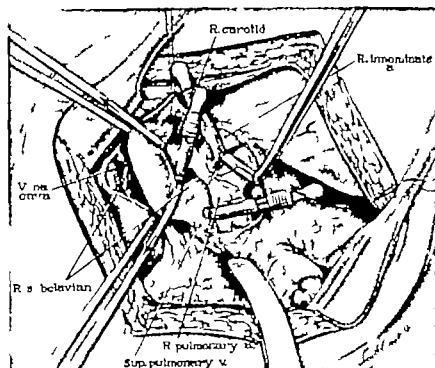


Fig. 35 Showing the anastomosis between the right subclavian artery and the right pulmonary artery in the presence of the anomalous position of the superior vena cava as depicted in Figure 34.

36) The completed anastomosis is depicted in Figure 37.

**Anomalies of pulmonary veins.** Some or all of the pulmonary veins may drain into the right auricle or its tributaries. Two such cases are shown in drawings in the preceding section. Despite the fact that no attempt was made to alter the site of the drainage in these cases at the time that an artificial ductus arteriosus was created, the patients have improved greatly.

Brody Brantigan and others have reported similar anomalies of the pulmonary veins and have reviewed the literature. With further improvement in diagnostic methods and surgical technique some of these anomalies can probably be treated successfully by operation.

#### TREATMENT AND RESULTS

The preoperative and postoperative care of most of the patients is not very difficult or complicated. Digitalis is recommended before operation for patients in whom the cardiac reserve is low. The removal of blood by vene-

section is seldom if ever indicated. Care should be exercised in the preoperative period to see that the patient does not become dehydrated because of the possibility that cerebral thrombosis may occur. A child should receive at least 1 600 cubic centimeters of fluid per diem and an adult at least 2 200 cubic centimeters per diem. The administration of penicillin should be begun before or shortly after the operative procedure.

The total quantity of fluids administered during the operation should equal approximately the loss of blood during the procedure. Unless blood loss is excessive the fluid is given in the form of plasma. If severe bleeding occurs, whole blood is administered. If the pulse rate should become alarmingly slow additional atropine is given.

All patients are placed in an oxygen tent on being returned to their rooms. Venesection is rarely performed. Aspiration of the pleural cavity on one or more occasions is performed in at least half of the cases. The administration of whole blood is indicated if a large accumula-

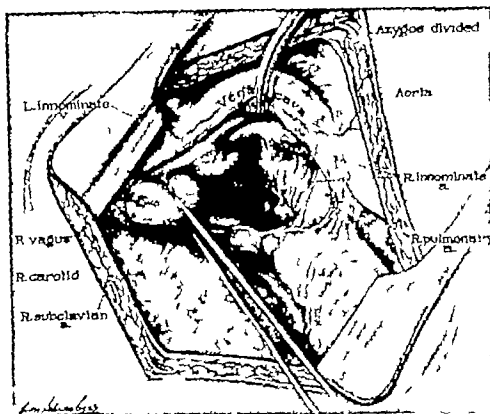


Fig. 36. Showing an anomalous position of the left innominate vein in which it lies posterior to the innominate artery

tion of blood in the pleural cavity occurs. The problem as to the quantity of fluid other than blood which should be given is a delicate one. The quantity should be sufficient to reduce the likelihood of cerebral and anastomotic thrombosis and should not be sufficient to cause pulmonary edema and heart failure. In general the total fluid intake each 24 hours in the early postoperative period should be 700 to 900 cubic centimeters in infants, 1,000 to 1,400 cubic centimeters in children and 1,800 to 2,200 cubic centimeters in adults. If evidence of cerebral thrombosis or occlusion of the anastomosis appears the administration of heparin is indicated. It is important to bear in mind that these patients need rest in the postoperative period and that they may be 'over treated as well as undertreated.

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the Johns Hopkins Hospital. A second anastomosis has been carried out on several of the patients. The total number of patients who have died is 108, an overall mortality rate of 17.7 per cent. Twenty-seven of the deaths occurred during the operation, 68 in the postoperative period and 13 after discharge from

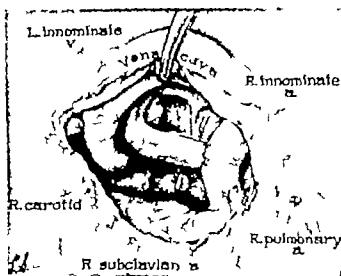


Fig. 37. Showing the relationship between the subclavian pulmonary arterial anastomosis and the innominate vein as demonstrated in Figure 36

the hospital. No known deaths are excluded. Some of the patients did not have a pulmonary artery which was suitable for anastomosis and death followed simple exploratory thoracotomy. The diagnosis was in error in some fatal cases. 7 of these patients had a transposition of the aorta and pulmonary artery. A few of the deaths were unrelated to the operative procedure, for example a child from France died of meningitis after returning home.

Twelve of the 27 deaths which occurred during operations were in the course of exploratory thoracotomies. In some of these instances the pulmonary artery was absent or was not suitable for an anastomosis. Six of the patients died while an anastomosis was being performed and 9 succumbed shortly after the blood vessel union was completed. In some instances the exact cause of death was not determined but it seems reasonably certain that the commonest cause of death during the operative procedure was cardiac anoxia.

Sixty-eight of the patients succumbed during the postoperative hospital period. In many instances the cause was not determined. The major cause or the contributing cause was thought to be cerebral thrombosis in 24 cases, cardiac failure or pulmonary edema in 16 cases, hemorrhage in 8 cases, thrombosis of the anastomosis in 5 cases, and respiratory complications in 3 cases. As was stated previously, autopsy examination did not explain the fatal outcome in a number of cases.

There have been 13 patients who died after discharge from the hospital from varied causes, some of which were not related to the operation. Included among the causes of death were heart failure, coronary occlusion, pneumonia, and cerebral accidents.

The mortality rate depends to a considerable extent upon the principles which one adopts in regard to operability. We have taken the position that almost all cyanotic patients who are believed to have an inadequate pulmonary blood flow and who are significantly incapacitated should be operated upon. The mortality rate in patients 2 years of age and older with a typical tetralogy of Fallot is low. We have had as many as 44

consecutive operations without a death. On the other hand the danger is considerably greater when patients have associated complications such as rotation of the heart and cardiac arrhythmias. The ideal set of conditions on preoperative study and at the time of operation are a moderate reduction in pulmonary blood flow, a normal sized or only slightly enlarged heart, a large and long subclavian artery, a pulmonary artery of moderate size, few collateral arterial channels to the lungs, a high pressure in the aorta and its branches and a low pressure in the pulmonary artery and a patient in the age group of 3 years to 10 years. On the other hand a more unfavorable prognosis accompanies operations on patients with heart failure, arrhythmias, rotation of the heart, a greatly enlarged heart (cardio-thoracic ratio 60+) or absence of a systolic murmur in the pulmonary area (suggestive of atresia). The outlook is particularly poor in infants.

An anastomosis between the proximal end of one of the subclavian arteries and the side of one of the pulmonary arteries has been performed in 433 patients who survived the termination of the operative procedure itself. In most of these the subclavian branch of the innominate was used. There were 45 deaths in the 433 cases, a mortality rate of 10.4 per cent. The diagnosis was in error in a few of the fatal cases. An anastomosis between the proximal end of a subclavian artery and the distal end of one of the pulmonary arteries was performed in 38 cases with 6 deaths, a mortality rate of 15.7 per cent. In most patients in this category the pulmonary artery was considered to be too small for a satisfactory end-to-side anastomosis.

Most of the cases in which the innominate or the carotid artery was used for the anastomosis were in the earlier part of the series. It is our opinion at present that it is rarely necessary to use one of these larger blood vessels, in the great majority of cases adequate mobilization of the arteries will allow one to use the subclavian artery. At any rate the carotid artery has been employed for the anastomosis in 34 cases with 8 deaths, a mortality rate of 23.5 per cent, and the innominate in 49 cases with 15 deaths, a mortality rate of

30.6 per cent. There is no doubt that ligation of the innominate or the carotid artery exposes the patient to a greater risk of cerebral complications. It is only fair to state however, that a number of the patients in this group were small, very sick children, and that part of the high mortality is ascribable to the poor general condition of the patients. A side-to-side anastomosis between the aorta and the pulmonary artery has been performed in only 2 cases with 1 death. In this fatal case the anastomosis was made too large and pulmonary edema developed. There were 24 exploratory thoracotomies with 4 deaths; no anastomosis being performed for various reasons.

The right or left subclavian artery has been ligated in approximately 555 cases. In most instances the ligatures were placed just distal to the point at which the vertebral artery arose the subclavian and the vertebral being ligated separately. There has been no serious interference with the circulation of the arm in any of these patients. Sympathetic nerve block has not been used. The affected extremity is slightly cooler than the opposite one for a while and a radial pulse is absent for an extended period. There has been no discernible impairment in function of the arm and hand in any instance.

The majority of the patients who have survived the operative procedure are improved. The degree of improvement ranges from that observed in some patients who seem to have no further limitations in activity to those who have definite restrictions. The detailed results in the first 300 cases will be reported shortly by Dr. Ruth Whittemore. Most of the patients show improvement in the color of the mucous membranes as soon as the anastomosis is established and blood studies demonstrate an elevation in the arterial oxygen saturation. During the following days and weeks the ar-

terial oxygen saturation continues to rise somewhat and the oxygen capacity, the hemoglobin, the red blood cell count, and the packed cell volume decline. The clubbing of the fingers and toes usually recedes gradually. The pulse pressure generally becomes greater than that found in the preoperative period and a continuous murmur is heard in the precordial area. The most notable alteration, however, is the lessening of the patient's incapacity. Many of the patients in the postoperative period appear to be amazingly free of limitations. Some of the patients who could walk only a few steps before operation can now walk miles. It must be emphasized, however, that the time since operation has been too short to allow an evaluation of the final results.

#### SUMMARY

In this lecture in honor of Doctor Rudolph Matas the surgical procedures employed and the anatomical variations encountered in the treatment of 610 cyanotic patients with a preoperative diagnosis of pulmonic stenosis have been enumerated, considered and illustrated. A brief account of the postoperative results has been given.

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## BACTERIOLOGY OF THE VAGINA IN 75 NORMAL YOUNG ADULTS

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SINCE the development of newer bacteriological methods few studies have been made of the organisms in the vagina of normal human adults. Topley and Wilson (21) discuss briefly the normal flora of the vagina after puberty naming Doederlein's bacillus as the predominant organism and mentioning several other frequent inhabitants including staphylococci streptococci coliform bacilli and diphtheroids.

In 1944 Rakoff analyzed the biologic characteristics of the vagina in 500 normal adults, 37 of whom were followed three times weekly through 1 to 3 menstrual cycles. In these he correlated vaginal acidity with the conventional grades of vaginal flora grade I Doederlein's bacilli only grade II Doederlein's bacilli and other organisms, grade III, organisms other than Doederlein's bacilli. He concluded that the normal vaginal flora is associated with pH 3.9 to pH 6.1 and consists of lactobacilli only. However he conceded that apparently normal vaginas may harbor other organisms, such as staphylococci, streptococci diphtheroids, coliform organisms, and yeast like forms.

The recent report of Hite, Hesselstine and Goldstein (10) concerning 248 normal and pathologic patients does not classify the subjects as pregnant and nonpregnant. It therefore is not suitable for analysis of the flora in normal nonpregnant adults.

In 1936 Weinstein and his associates (25) made a survey of the vaginal flora at various ages in a group of 99 nongravid adults with marital introitus and with normal menstrual histories. Forty-five of these had leucorrhea and cervicitis, while 54 had normal vaginal tracts. In this group of 99 by examining smears, he divided the flora into three groups

which differed from the conventional grades in that Doederlein's bacillus was included in group III as well as in groups I and II, and group III was distinguished from group II by the presence of diphtheroids. A similar classification could not be made from cultures. He listed the pelvic lesions associated with various bacteria but did not give the complete flora of any of the normal individuals.

In 1938 Weinstein (23) reported a study of 375 patients, including healthy unhealthy pregnant and nonpregnant individuals. He could find no correlation between vaginal pH and the type of flora nor could he group the flora into conventional grades.

Some of the organisms frequently cultured from the vagina have been studied in detail. Soule and Brown (17) reviewed the literature concerning anaerobic streptococci in the vagina, quoting positive cultures in 40 per cent of apparently normal women (Rosowski). The other studies reviewed as well as the series of Soule and Brown dealt with pregnant individuals.

Hite and Hesselstine (11) recently isolated 92 strains of streptococci from the vagina and uterus. This procedure however as well as their review of the literature deals chiefly with pregnant and postpartum patients.

Likewise studies of staphylococci from the human vagina frequently are based on cultures from prenatal and postpartum patients. Weinstein's series (24) included 233 cases of nonpregnant women, with an incidence of 48.8 per cent cultures positive for staphylococci. From his total series of 419 individuals, he isolated 19 strains of staphylococci, many of which gave reactions suggestive of pathogenicity.

Surprisingly the Doederlein bacillus, though considered the predominating vaginal organism, is of uncertain identity. Bergey's *Manual of Determinative Bacteriology* describes 15 defi-

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nite and 8 possible species of lactobacilli but does not mention the vagina as a source for any of them. The description of *Lactobacillus acidophilus* corresponds fairly well with the characteristics usually ascribed to the Doederlein bacillus. Although Topley and Wilson use the term Doederlein's bacillus in discussing the vaginal flora, they state elsewhere (20) in the same text in discussing lactobacilli "It seems probable that some species that have been called by different names are in reality identical. It seems likely that Doederlein's bacillus for example, is the same as *Lactobacillus acidophilus*." The text of Jordan and Burrows recalls the old synonyms of Doederlein's bacillus *Bacillus vaginalis* and *Bacillus crassus* and states that it is a common constituent of the flora of the vagina. However they dismiss a detailed discussion of it with the statement that it is thought to be identical with *Lactobacillus acidophilus*. The term Doederlein's bacillus and its synonyms seem to be disappearing quietly from the newer editions of text books of bacteriology.

Independent investigators have conflicting views as to the identity of the vaginal lactobacillus. Thomas reviewed the conflicting ideas in the literature from the time of Doederlein's original description in 1891 until 1926. His own work in 1928 consisted of a study of the microscopic, cultural and serological characteristics of organisms from 107 specimens obtained from normal vaginas, including 8 strains of lactobacilli. His final conclusion based chiefly on agglutination reactions was that Doederlein's bacillus is *Lactobacillus acidophilus* and that "no new names for the vaginal bacilli are justified." Lash and Kaplan however believed that of their four strains of Doederlein's bacilli, two were identical with strains of *Lactobacillus acidophilus* one with *Corynebacterium segmentosum* but that one, strain B, deserved the name *Lactobacillus vaginae*. Likewise Brown and Redwitz reported serological differences between Doederlein's bacillus and *Lactobacillus acidophilus*.

Previous investigators of the vaginal flora have tended to concentrate their attention on the cultural characteristics of certain bacteria

or to enumerate the complete range of organisms isolated without a clear division of their source from normal or abnormal subjects. A search of the literature fails to reveal a complete list of vaginal organisms obtained from a group of healthy women. Thus the interpretation of vaginal cultures is confused by ignorance in regard to the range of physiological variations of the vaginal flora. The present investigation was prompted by the need to establish such a distinction in various age groups. The preliminary study to be reported is concerned with the vaginal organisms from a group of seemingly healthy young women.

#### METHODS

**Material.** Student nurses without signs or symptoms of gynecologic disease were used as volunteers. Ages ranged from 17 to 25 years. None were married. In several instances the material was discarded because of technical difficulties such as contamination when the introitus was very small. The series to be reported consists of 75 cultures and smears.

**Technique of obtaining material.** The device used for obtaining cultures consisted of a cotton swab on a wooden applicator about 12 centimeters in length, contained in No. 7 glass tubing about 8 centimeters long. The bore was just large enough to allow free movement of the swab. The devices were kept in separate cotton plugged glass test tubes of suitable length.

No perineal clean up was used. The labia were parted widely in such a manner that pressure was directed toward the perineum, and the hymenal opening was made to gape. Through this opening the glass cylinder was passed well into the vagina without touching the introitus or lower vaginal walls. The swab was then pushed from its protected position inside the glass container and was carried 2 to 4 centimeters higher in the vagina. After the swab had been twirled a few times it was withdrawn into the tube, and the tube withdrawn from the vagina. With the labia still separated one end of a strip of nitrazine paper was then passed into the lower vagina and allowed to become moist. By comparing this with color charts, the pH was determined. This procedure was not carried out in 7 of the 75

TABLE I.—VAGINAL ORGANISMS CULTURED FROM 75 UNMARRIED HEALTHY YOUNG WOMEN\*

Organism	N. of individuals from whom grown	Percent total cases cultured
Lact bacilli	6	8.6
Diphtheroid	4	5.6
Streptococci	4	5.6
Staphylococci		3.3
Coliform	1	1.3
Unidentified n. f.		6
Unidentified cocci		3
Gaffky trigena species		3
Candida stellata	3	4
Candida krusei		3
Vac. harmani		3
Cryptococcus species	1	3

\*Specimens from subjects showed no growth

After cultures were planted the swabs were used to make a smear for Gram's stain and to make a saline suspension which was used in searching for trichomonads.

**Culture methods.** All cultures were planted immediately usually within 5 minutes after obtaining the material. Cultures were set up as follows: (1) aerobic blood agar plates, pH 7.3 incubated at 37 degrees for 24 hours; (2) anaerobic blood agar slant, pH 7.3 incubated at 37 degrees for 4 to 48 hours; (3) chocolate blood agar plates, pH 3 under about 10 to 20 per cent CO<sub>2</sub> tension for 48 hours; (4) Sabouraud's slant at room temperature for 1 to 2 weeks.

In some instances, the aerobic and anaerobic cultures were first incubated 18 to 24 hours in B. B. L. Brewer's thioglycollate broth and then subcultured to the blood agar plates and slants. Blood agar plates were made by adding human blood to bacto-nutrient agar. Chocolate agar plates were made by adding fresh sterile defibrinated blood to hot bacto-proteose No. 3 agar. Anaerobiosis was achieved by placing the agar slant in a larger tube containing sodium hydroxide pellets and pyrogallic acid crystals and about 1 cubic centimeter of water. The large tube was then closed with a cork stopper and sealed with melted paraffin. The chocolate agar plates were incubated in a candle-jar to provide carbon dioxide. Colonies which grossly and on stained smear seemed to belong to the coliform group of organisms were subcultured to desoxycholate plates and to

TABLE II.—GROWTH OF STREPTOCOCCI FROM VAGINA UNDER VARIOUS ATMOSPHERIC CONDITIONS

Atmospheric conditions	N. of positive cultures			
	Beta	Alpha	Non-hemolytic	Total
Aerobic				
Anaerobic			2	12
Carbon dioxide		3	6	19
				31

carbohydrate fermentation tubes. On anaerobic plates colonies of lactobacilli and diphtheroids were usually identified by their gross appearance and by their appearance in stained smears. Pigment formation of staphylococci was determined by subculture to milk agar. Sarcinae were identified by yellow pigment and by the typical cubical arrangement. The *C. affinis* was identified by the typical arrangement in tetrads. Both aerobic and anaerobic streptococci were transferred to thioglycollate broth to check for chain formation from the broth and blood agar poured plates were made to determine the type of hemolysis. In the single growth of beta streptococci the Lancefield grouping was not determined. When the chocolate agar plates had colonies suggestive of neisseria they were subjected to the oxidase test by flooding with a solution of 10 milligrams of p-aminodimethylaniline monohydrochloride in 1 cubic centimeter of water. False positive reactions were frequently encountered especially with gram positive rods but were not confusing since the color faded within a few minutes.

The lactobacilli on chocolate agar were easily identified as dry colonies usually imparting a green discoloration to the medium. Microscopically they had a typical long-chained arrangement and took the Gram's stain irregularly.

Yeast like organisms were identified and the species of candida differentiated by the commonly accepted methods (7-18) of identifying hyphae, mycelia buds and chlamydospores. Subcultures were made to cornmeal-dextrose agar plates and fresh carbohydrate fermentation tubes which were then overlaid with vaseline. For final identification of Can-

TABLE III.—GRADES OF VAGINAL FLORA OBTAINED FROM CULTURES

Grade	No. of cases	Incidence Per cent
O	10	13.33
I	37	49.33
II	25	33.33
III	3	4.00
Total	75	99.99

*S. albidus* a 2 per cent suspension in saline was injected into the marginal ear vein of a rabbit

## RESULTS

*1 Organisms demonstrated, their incidence and cultural characteristics* The organisms cultured and their incidence are shown in Table I. Of the 24 growths of streptococci, 14 were nonhemolytic, 7 alpha 1 beta, and 2 unidentified. The streptococci were interesting in their frequent failure to grow aerobically. In the 1 instance in which growth of streptococci was obtained under aerobic conditions, similar (nonhemolytic) colonies were obtained on the anaerobic blood agar slant and on the chocolate agar plate in the carbon dioxide jar. The single growth of beta hemolytic streptococci was on an anaerobic plate. The distribution of growth under aerobic and anaerobic conditions and in the carbon dioxide jar is shown in Table II. In 13 of the 14 individuals with positive cultures for streptococci there was an associated growth of lactobacilli.

In this study, no detailed investigation of staphylococci or of diphtheroids was done.

Of the 13 individuals from whom no lactobacilli were grown, 10 had completely sterile cultures. It was impossible to identify any technical errors to explain this.

In 60 (96.8%) of the 62 cultures positive for lactobacilli, growth was obtained on the carbon dioxide plate. In the other 2 instances, growth occurred on aerobic blood agar plates only. Ten of the 60 positive cultures on carbon dioxide plates were accompanied by growth of lactobacilli on the aerobic or anaerobic culture media, or on both (Table IV).

Seventy-one (94.7%) of the direct smears contained large bacilli suggestive of lactobacilli. In 5 instances, however, these rods were

TABLE IV.—DISTRIBUTION OF POSITIVE CULTURES OF LACTOBACILLI ON VARIOUS MEDIA

Media	No. positive cultures of lactobacilli	Per cent of positive cultures
Carbon dioxide plates only	50	80.7
Aerobic plates only	2	3.2
Anaerobic plates only	0	0
Aerobic and anaerobic plates	0	0
Aerobic and carbon dioxide plates	2	3.2
Anaerobic and carbon dioxide plates	6	9.7
Aerobic, anaerobic, and carbon dioxide plates	2	3.2
Total	62	100.0

gram negative and the presumptive evidence of lactobacilli in direct smears may thus be reduced to 88.0 per cent. In all 13 of the cases with negative cultures for lactobacilli the direct smear showed bacilli consistent with this organism, and by combining information from both cultures and direct smears, there is evidence of lactobacilli in 75 members of the series (100%).

Study of the direct smears for organisms other than lactobacilli was of little value. Cocci and small rods could seldom be identified with assurance. In no instance were cocci in chains noted. The saline suspensions showed motile trichomonads in 2 instances.

*2 Relation of organisms to each other* In 37 instances (49.3%) lactobacilli only were cultivated. Three cultures yielded other organisms but no lactobacilli and would compose the group usually described as grade III. The conventional grading does not provide for the 10 instances in which no growth was obtained. We have designated this group as grade O in Table III which shows the incidence of the various grades from cultural evidence alone. If presumptive evidence from the smears is combined with the above information, grade O would be eliminated and the 10 cases would be added to grade I while grade III would be reduced to 1 case.

*3 Relation of pH to flora* In all members of the grade I group the pH was 4.5. The 5 individuals from whom fungi were grown also had pH 4.5. Otherwise grades or specific organisms cannot be correlated with degree of vaginal acidity. Of the 12 individuals with positive cultures for streptococci in which the pH is known, the readings are distributed as follows: 4.5, 6 cases; 5.5, 3 cases; 5.0, 6.5

TABLE V.—TECHNIQUE AND RESULTS OF SMEARS AND CULTURES FOR DOEDERLEIN'S BACILLUS

Investigator	N. of lavages	Vagina cleaned	Delay in plating	Media used	Atmosphere for culture	Positive cultures per cent	Positive stained smears per cent
Lash and Kaplan	93	on H <sub>2</sub> O <sub>2</sub>	None	Dextrose broth. Subculture on blood agar. Lacto medium on dextrose agar plates	All aerobic. Also 3 anaerobic	3	43
Thomas	107	Green soap Sterile (d) on H <sub>2</sub> O <sub>2</sub>	None	Whey agar plates	Aerobic and Anaerobic	7.3	13.1
Crickshaw			2-3 hrs.	1% lactose or glucose hormone agar (on 1-5 dehydrated rabbit blood)	Aerobic		
Wronson	373	Y	hr. or less	Tomato peptone peptonized milk, yeast agar	Under CO <sub>2</sub>	(non-prepared series) (no in-prepared series)	Not reported
Lock et al	73	Y	3 min. or less	Chocolate agar	Under CO <sub>2</sub>	8.6	33 (corrected) (94% including from my only remaining larvae: 13)

and 7.5 in 1 case each. Nine individuals had readings of more than 4.5 distributed as follows: pH 5.0 in 4 cases, 5.5 in 3 cases, 6.5 in 1 case and 7.5 in 1 case.

Seven of these had grade II flora including the ones with pH 6.5 and pH 7.5. Two with grade III flora had pH readings of 5.0 and 5.5 and 1 individual with grade III flora had a vaginal pH of 4.5. No correlation could be made between pH vaginal flora and the number of days since the last menstrual period or until the next expected menstrual period.

4 *Relation of personal cleanliness to vaginal cleanliness.* No satisfactory method of evaluating personal cleanliness could be devised. From a record of the hours since the last bath no correlation could be made with the vaginal flora.

5 *Influence of flora on vaginal secretions.* Although all individuals originally denied any gynecological complaint 27 answered in the affirmative when asked directly if they were aware of any vaginal discharge. From the intermittent character and time of occurrence 6 were definitely and 7 possibly traced to the premenstrual phase of the menstrual cycle. The remaining 14 had a continuous slight discharge. Four of the 27 had negative cultures, 12 had grade I, 9 had grade II and 2 had grade III flora. Of the 5 individuals harboring fungi 3 had no discharge. This included the individual who harbored both *Cryptococcus* species and *Candida Krusei*. Two

positive cultures for *Candida stellatoidea*, had a slight discharge described as thin, white nonirritating and odorless. In the 2 individuals harboring trichomonads no vaginal discharge had been noted.

#### DISCUSSION

Our method of growing lactobacilli in an atmosphere of 10 to 20 per cent carbon dioxide is not new but its effectiveness has not been emphasized in previous writings (8,10,13,22,25,26). Further work seems indicated to determine whether it is the chocolate agar, the carbon dioxide atmosphere, the associated reduced oxygen tension, the choice of subjects, method of taking cultures or the technique in plating the material that accounts for our relatively high incidence of positive cultures (Table V). A discrepancy between stained smears and cultures of vaginal lactobacilli is not unusual as shown in Table V.

Our introduction of the term grade 0 flora is possibly superfluous since stained smears furnished evidence that the negative cultures represented a failure to cultivate organisms which were present. This grouping however places such organisms into a separate category with different cultural characteristics from those which were cultivated. Thus 13.3 per cent of our present series of individuals harbored organisms which did not survive the usual methods of culture. This fact assumes importance compared with an incidence

in our laboratory of only 3 per cent negative vaginal cultures from patients with various gynecological complaints. Further attempts at isolation and identification of the organisms of grade O flora seem indicated.

Our failure to correlate the higher pH range with grade III flora is in agreement with the work of Weinstein (23). It is also interesting to note that a combined lactobacillus-streptococcus flora is associated with both high and low pH. This is contrary to the classical conception that these organisms each grow in a pH range which the other cannot tolerate. Our finding lactobacilli in the vaginas of pH of about 7.0 supports Weinstein's (23) contention that there is no direct correlation between the presence of lactobacilli in the vagina and its degree of acidity.

It is interesting to note that the streptococci were almost all microaerophilic or anaerobic. This fact raises a question as to how often such organisms may be lost if cultures are not planned to take into account adaptation to special environment in the various body cavities.

Although *Candida stellatoidea* and *Candida Krusei* are believed to be causes of vulvovaginitis (5, 12) the 4 individuals who harbored these yeasts in the present study had no pruritus and only 2 had a slight discharge. A growth of *Cryptococcus* species is usually considered to be due to air contamination (6) but in this instance may represent a true vaginal saprophyte since several colonies developed both on Sabouraud's media and on blood agar.

Several features of this study are open to criticism. The series is short. The individuals were not followed with repeated cultures. The method of determining the pH was crude. The extent to which *Staphylococcus albus* and the streptococci were respiratory contaminants is uncertain. No attempt was made to demonstrate the organisms requiring special methods. It might be argued that spirochetes, tubercle bacilli, pleuropneumonia-like organisms (3, 14), or other rare inhabitants of the vagina were missed.

All techniques for obtaining vaginal cultures are unsatisfactory, and it is doubtful if a real vaginal culture has ever been obtained. Harris and Brown (9) devised a method which

in their hands was satisfactory. They used a tube within a tube, the outer one wearing a rubber cuff which was protected by protrusion of the inner tube. However, Adair and associates have shown that the Harris-Brown technique as well as several other methods failed to prevent contamination from organisms of the perineal region. Our method seemingly obviated this objection since the device used did not touch the introitus or even the vagina for a distance of about 1 1/4 centimeters. Thus ascent of any organisms would be from the lower vagina and not from the vulva. Our method is easily applied to nulliparous individuals but might be unsatisfactory in the presence of large cystoceles or rectoceles.

If vulvar contamination occurred in our present study it would chiefly affect the statistics in regard to the occurrence of staphylococci. In regard to possible contamination from the perineum it is interesting to note that no culture was positive for *Streptococcus fecalis* and that coliform organisms were recovered in only one instance.

#### SUMMARY

A survey was made of the vaginal flora in 75 normal unmarried young women.

Culture media and methods were those used in the ordinary bacteriology laboratory for routine cultures plus chocolate agar, carbon dioxide for lactobacilli.

Lactobacilli were cultured from 82.6 per cent of the subjects. This was a higher yield than any that has been recorded by previous workers.

Stained smears furnished presumptive evidence that lactobacilli were present in 100 per cent of the subjects.

The flora was classified according to the classical grades: 49.3 per cent fall into grade I, 33.3 per cent into grade II, and 4.0 per cent into grade III. In 13.3 per cent of the subjects the cultures were sterile (grade O).

Grade II and grade III flora cannot be correlated with the vaginal pH. In all instances grade I flora was associated with vaginal pH 4.5.

Besides lactobacilli, other organisms obtained on culture were diphtheroids, Staph

ylcococcus albus, streptococci colliform organisms, and yeast like fungi

All the streptococci grew under carbon dioxide or anaerobically

Ninety six and eight tenths per cent of the lactobacilli grew on chocolate agar in carbon dioxide jars.

### CONCLUSIONS

1 Healthy unmarried young adult females usually harbor lactobacilli within the vagina about one-half also harbor other organisms, chiefly diphtheroids, Staphylococcus albus, and streptococci.

2 Lactobacilli can exist in vaginas ranging in pH from 4.5 to 7.5

3 Cultivation of vaginal lactobacilli on chocolate agar in a carbon dioxide jar gives the most satisfactory yield reported to date but cannot be considered an ideal method.

4 Vaginal streptococci are adapted to a low oxygen environment.

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# INFLAMMATORY CARCINOMA OF THE BREAST

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**T**HAT certain malignant lesions of the breast may simulate inflammatory lesions clinically has long been a matter of common knowledge to clinicians and pathologists. Although clinically these lesions do not present the usual picture of carcinoma of the breast and often have been mistaken for inflammatory lesions pathologically they represent a very virulent type of cancer. They have been described by various writers under a great many different names. To denote its resemblance to inflammation the condition has been called mastitis carcinomatosa (27,38) carcinomatous mastitis (10) carcinoma mastoides (35) erysipeloid carcinoma (4 6 16 20 26 29 30 32 33) mammary carcinoma with cutaneous carcinosis of erysipeloid type (8) and inflammatory carcinoma (13 15 22, 36 41). It has also been called brawny breasts (1) acute cancer (3 15 19 21 23 25 31) telangiectatic carcinoma (9 37 40) and subepidermoidal carcinoma of the breast (11, 12).

The purpose of this study was to describe and classify this type of disease to investigate its pathologic characteristics and to correlate its clinical manifestations with its pathologic characteristics.

## MATERIALS AND METHODS

Approximately 7,000 consecutive cases of malignant lesions of the breast encountered at the Mayo Clinic from 1933 through 1945 were reviewed. All cases in which inflammatory signs such as redness and edema were manifested or in which inflammatory disease had been diagnosed before the malignancy of the lesion was recognized were selected for further study. It became apparent that redness and

edema were frequently present in cases of malignant lesion of the breast in which the breast was enlarged and in which the lesion was diffuse rather than localized. These cases were, therefore added to the study.

After discarding those cases in which the redness and edema were localized and obviously due to early necrosis and infection from invasion of the skin 74 cases which seemed characteristic were finally selected. In 61 of these radical mastectomy had been performed in 2 simple mastectomy and in 2 biopsy. Tissues obtained in these 65 cases were studied in detail including multiple blocks cut from all parts of the breasts which had been removed. Paraffin sections were made and stained with hematoxylin and eosin.

For purposes of orientation and control 50 additional cases of noninflammatory carcinoma of the breast were subjected to a similar examination.

## CLINICAL FINDINGS IN 74 CASES

*Incidence.* Of approximately 7,000 cases of malignant lesion of the breast 74 were judged to be characteristic of the so-called inflammatory carcinoma type. This is an incidence of about 1 per cent.

*Age and sex.* The youngest patient in the series was 32 years old and the oldest was 72. The average age was 52.6 years. All of the patients were women.

*Side affected.* It was interesting that the left breast was involved almost twice as frequently as the right. In the total of 74 cases the lesion affected the left breast primarily in 46 the right in 28.

*Bilaterality.* At the time of initial examination at the clinic 2 patients already had bilateral inflammatory carcinoma and another had scirrhous carcinoma of different grade in the breast opposite the one which contained the inflammatory carcinoma. In 6 cases carcinoma subsequently developed in the remain-

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Fig. 1 Symmetrical enlargement of the breast in the presence of inflammatory carcinoma. The first diagnosis, which had been made by a physician elsewhere, had been fungus infection.

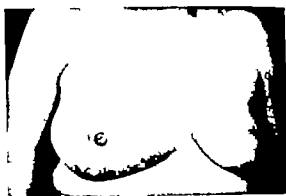


Fig. 2 Diffuse enlargement and discoloration of the breast in case of inflammatory carcinoma. This patient had been told by her physician that she had mastitis and she had been treated with estrogen.

ing breast and 1 patient had undergone radical mastectomy for Paget's disease 2 years previous to her examination at the clinic.

Altogether 10 patients or 13.5 per cent of the group eventually had bilateral carcinoma of the breast. The time interval between the appearance of disease in the first and second breasts varied from 4 months to 7 years with an average of 2 years. In no instance did the carcinoma appear to occur simultaneously in both breasts.

**Pregnancy and lactation.** Twenty-four of the 74 patients had never been pregnant. One had been pregnant a short time before admission and was still lactating.

**Duration of symptoms.** The average duration of time before these patients came to the clinic after first noticing something wrong with their breasts was 7 months. The longest period of time was 5 years and the shortest 8 days.

**Signs and symptoms.** As implied by the descriptive names previously given to this condition its clinical signs are largely those of inflammation. So much did the condition in some of these breasts resemble an inflammatory process that it was erroneously and perhaps tragically treated as such. It is not surprising that in 14 (18.9 per cent) of the 74 cases, the condition was diagnosed inflammatory disease before its true carcinomatous nature was discovered.

The cardinal symptom of carcinoma of the breast is a lump, but in these cases a lump was

noticed by only 62 per cent of the patients. Physical examination commonly revealed diffuse induration extending through much or all of the breast. In 45 per cent of the cases the tumor could not be palpated when the patient was examined at the clinic and in the others it was poorly demarcated.

Most carcinomas do not cause an increase in the size of the breast. Inflammatory carcinoma on the contrary frequently enlarges the breast. Enlargement of one breast was the patient's first inkling of trouble in 6 cases (8.1 per cent). On examination at the clinic the affected breast was described as being enlarged grossly in 38 cases, a little more than half the total number. The enlargement consisted not of a tumorous protrusion but rather of a symmetrical increase in the size of the whole breast (Figs. 1 and 2).

The skin of the breasts was red or edematous or both as if there was infection beneath. The redness varied from a rosy hue over the center or lower part to an angry red or violaceous color of the whole breast, sometimes even extending over the thoracic wall and to the axilla. Likewise the edema varied from slight puffiness of the skin to sodden thickening which pitted on pressure. Both the redness and edema were intensified when the patient stood for a long time and receded when she lay down. The lower dependent portion of the breast was more often and more severely affected. Seventy-three per cent of the breasts were described as being red and 78 per cent



Fig. 3. Massive diffuse involvement of entire breast. Note thickening of skin.



Fig. 4. Diffuse growth in strands throughout the breast. The carcinoma can be seen grossly extending along the suspensory ligaments of Cooper. The thickening and edema of the skin are apparent.

were edematous on physical examination (Since these data were taken from records which in some cases were incomplete it is felt that the incidence of redness and edema was probably higher perhaps nearly 100 per cent.)

It is true that redness and edema occur over a carcinoma which is infiltrating the skin and causing necrosis and ulceration. These however result from true inflammation and are not to be confused with redness and edema caused by inflammatory carcinoma.

Pain was a frequent symptom. Fifty three per cent of the patients had pain at some time during the course of their disease, and in 26 per cent of the cases pain was the first symptom noticed.

Clinical examination revealed attachment of the skin to the underlying malignant tissue in 44 cases (59.4 per cent).

The nipple was noted as being retracted in 54 per cent of the cases.

Despite extensive involvement of the breasts in many cases there were only 2 instances of ulceration of the skin. It occurred very late in a case of bilateral massive involvement which was treated only with roentgen rays. In the other case an ulcer of a deeply retracted nipple was present.

#### **PATHOLOGIC FINDINGS IN 65 CASES**

**Gross examination.** The affected breasts were all large and the discoloration and edema observed clinically were apparent in the specimens.

**Skin.**—On cut section the skin was found to be remarkably thickened and edematous

measuring from 2 up to 8 millimeters in thickness and averaging about 4 millimeters.

In none of the specimens was the skin destroyed by the growth. Even in those breasts in which the tumor seemed to occupy the entire substance of the breast the skin remained intact over it. In the 2 aforementioned exceptions pathologic examination could not be carried out in the case in which only irradiation was given and in the other the ulcer involved only the nipple.

**Tumor.**—In general the outstanding characteristics of the growth were its diffuseness and its extensiveness. In 28 cases (43 per cent) the growth was so widespread that there was no evidence of localization whatsoever (Figs. 3 and 4). Instead there were strands of diffusely growing carcinoma throughout the breast. Sometimes the clusters of malignant cells did not seem to be connected with one another and in 3 such instances the clusters were so widely separated the growth was classified as multicentric. In 16 specimens or 24.6 per cent there was a diffuse growth in the breasts but a localized tumor could also be recognized. In 19 cases or 29.2 per cent a localized tumor without diffuse extension was present.

When there was a localized tumor in most instances it was very large. The size varied however from 2 by 1.5 by 1.5 centimeters to 12 by 11 by 7 centimeters. The average size was 6 by 5 by 5 centimeters.

Among the growths which were well enough localized to allow specification of their positions in the breasts, 17 occupied the center of the breast, 8 were so large as to occupy practi-

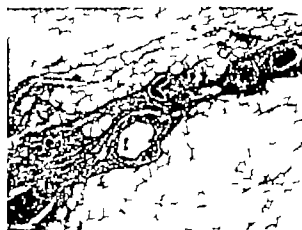


Fig. 5. Carcinoma spreading through the lymphatics in suspensory ligament of Cooper (hematoxylin and eosin  $\times 35$ ).

cally the entire breast 6 were in the upper outer quadrant and there was 1 each in the lower inner quadrant, upper half lower half and outer half.

**Lymph nodes**—The axillary lymph nodes were enlarged and firm in all cases but they did not differ in appearance from those of the usual case of carcinoma of the breast with gross metastasis to the axillary lymph nodes.

**Microscopic examination** The massive involvement noted grossly was confirmed on microscopic examination. The carcinoma was widespread and was found to be growing in all directions from the main masses of tumor tissue. Especially prominent were the ligaments of Cooper (Fig. 5) in which the cancer apparently was spreading by way of the lymphatic vessels.

**Lymphatics**—In the course of microscopic examination as the ligaments of Cooper were followed to the skin the subepidermal lymphatics were encountered spreading peripherally. In 86 per cent of the cases these lymphatics contained carcinoma cells and this was a characteristic feature of the disease. These lymphatics lay at the level of the sweat and sebaceous glands and ran parallel to the surface of the skin (Fig. 6a and b). In some breasts every subepidermal lymphatic seemed plugged with cancer cells (Fig. 6c) while in others many sections had to be cut before involved lymphatics could be found. In 13 breasts or 20 per cent carcinoma cells were

TABLE I—POSTOPERATIVE SURVIVAL OF PATIENTS WHO HAD INFLAMMATORY ADENO-CARCINOMA OF THE BREAST

	Years				
			3	5	
Patients followed	30	40	40	42	42
Patients known to have died	16	32	43	44	46
Patients known to have been alive	14	7	7		
Per cent known to have been alive	46	25	24	6	

not found in the subepidermal lymphatics, but in 4 of these and in the specimens removed for biopsy in the 2 cases in which the lesion was inoperable carcinoma was found in the deeper lymphatics. Carcinoma cells were found in the lymphatics in 86 per cent of the cases in which surgical exploration was carried out.

**Blood vessels**—The subepidermal capillaries, which run in the same plane as the lymphatics were generally distended and engorged with blood. Cancer cells were found there in only 2 cases, but blood vessels containing carcinoma cells were found deeper in the breast in 13 instances making a total of 15 cases or 23 per cent in which intravascular spread occurred (Fig. 7a).

**Skin**—The edema of the skin visible grossly was found on microscopic examination to be mostly in the dermis, through which ran the subepidermal lymphatic and blood vessels (Fig. 6b and c). The carcinoma cells were found in the lymphatics and blood vessels of the skin but did not infiltrate the skin directly. There were no cancer cells in the epidermis, nor was there necrosis or abscess formation.

**Inflammation**—Lymphocytes and plasma cells were present in abundance at the margins of the carcinoma, but no more so than at the margins of the usual carcinoma of the breast. In the ligaments of Cooper and at the level of the subepidermal vessels there was an increased number of perivascular lymphocytes and plasma cells (Fig. 7b). In 28 cases (43 per cent) the increase was more marked than is usual in cases of carcinoma of the breast. It was impossible to correlate either the gross or microscopic extent of the disease with the number of lymphocytes and plasma



a



b



c

Fig 6 a. Carcinoma in the subepidermal lymphatics at the level of the sweat glands. Note the edema of the dermis (hematoxylin and eosin  $\times 35$ ). b. Subepidermal lymphatic spread. Edema and thickening of the epidermis can be seen (hematoxylin and eosin  $\times 35$ ). c. Plugging of subepidermal lymphatics with cancer cells (hematoxylin and eosin  $\times 35$ ).

cells. Breasts in which every subepidermal lymphatic seemed plugged with carcinoma did not necessarily display greater perivascular reaction than those breasts in which the presence of carcinoma cells was comparatively infrequent. Nor was the amount of redness and edema related to the number of lymphocytes and plasma cells present.

In no instance was there evidence of acute inflammation or suppuration.

**Grade of malignancy.**—In all cases the carcinoma was highly anaplastic. Graded on the basis of 1 to 4 by Broders' method in which in grade 1 the cells are most differentiated and in grade 4, least differentiated. 88 per cent of the lesions were graded 4 and 12 per cent were graded 3. All were adenocarcinomas and 5 were mucus producing. Axillary nodal metastasis was present in 100 per cent.

**Characteristics of growth.**—Nothing distinctive could be found in the individual cells nor in the architecture of the growth. It was, however, in the manner of its spread that this carcinoma manifested its individuality. Rather than growing as a directly infiltrating mass it disseminated itself through lymphatics and blood vessels.

#### TREATMENT AND PROGNOSIS

Sixty three of the 74 patients underwent mastectomy. In 61 cases radical mastectomy was performed and in 2 simple palliative mastectomy. All but 1 of the patients were given postoperative irradiation. In 10 of the 11 cases in which the condition was inoperable because of obvious spread beyond the limits of surgical excision roentgen therapy was given.

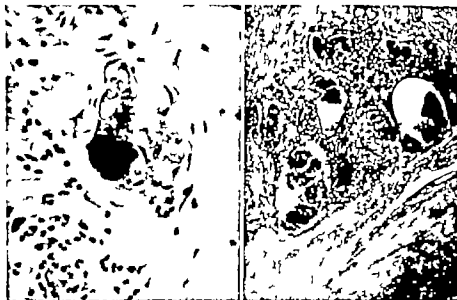


Fig. 7. Capillary spread of the carcinoma (hematoxylin and eosin  $\times 350$ ). b, Marked lymphocytic reaction around carcinoma cells in lymphatics (hematoxylin and eosin  $\times 80$ ).

It was possible to follow up 7 of the patients who had inoperable lesions. None of them lived more than 3 years. Of the group that received surgical treatment some were treated too recently for appraisal and it was not possible to follow up a few of the others. Some were known to have survived several years and then further information concerning them could not be obtained. Information concerning survival is given in Table I.

There was no appreciable difference in prognosis in those cases in which the lesion was graded 3 and in those in which it was grade 4—an observation emphasizing the widespread nature of the disease.

Recognizable metastasis aside from that to the axillary and supraclavicular nodes was known to have developed in 42 of the 74 cases studied. By far the most frequent site of metastasis was the skin (54 per cent of 41 cases). In 20 of the 23 cases in which the lesion metastasized to the skin it metastasized to the skin of the thoracic wall and in one each to the arm and axilla on the same side and to the abdominal wall on the side opposite the lesion. In 2 instances there were recurrences in the scar left after previous mastectomy. Other common sites of metastasis were bone (38 per cent) thorax, including

lung pleura and mediastinum (33 per cent) and the opposite breast (21 per cent) (Fig. 8). The total of the percentages equals more than 100 per cent since in several cases there was more than one site of metastasis.

#### COMMENT

The age incidence for inflammatory carcinoma in our series seemed to be about that for carcinoma of the breast in general. The average age of the patients was 56.2 years, which is similar to the average age (51.3 years) which Harrington (17) found in a study of 6195 consecutive cases of carcinoma of the breast at the Mayo Clinic. Although all patients in this series were females Schreiner and Volavsek and Rotter described occurrence of inflammatory carcinoma of the breast in the male.

Some writers including Boyd, Schumann, Volkman, Da Costa, Gronwald and Ibarbia and Bessone have suggested that the occurrence of this type of carcinoma is related to pregnancy and especially to the postpartum period. Others (Lee and Tannenbaum, Taylor and Meltzer and Dawson and Shaw) did not believe that inflammatory carcinoma was particularly prone to occur during this period. Learmonth emphasized the mistake in coo-

fusing the rapidly growing carcinomas in younger women with true inflammatory carcinoma. Among the 74 cases studied pregnancy and lactation did not appear to have any relationship to the development of inflammatory carcinoma.

The high incidence of bilateral involvement in cases of inflammatory carcinoma has been noted by Dawson and Shaw, Ibarbia and Bessone, Bloodgood, Taylor and Meltzer, Weber (39), Rasch and Brackertz. In 13 per cent of our series bilateral carcinoma of the breast developed. This is appreciably more than the 6 to 8 per cent Harrington (18) found in a review of 6261 cases of all types of carcinoma of the breast.

Among those who have studied the pathology of inflammatory carcinoma, there has been much controversy as to whether this type of malignant lesion spreads through the lymphatics or blood vessels. Leitch, Fischer, Camiel and Bolker, Orbach and Schreiner, and Volavsek believed that it spread through the lymphatics while Küttner, Freeman and Lynch, Nanta and Salvador, Rasch and Van Vonn found it spreading in the blood vessels. Still others (Lee and Tannenbaum, Ibarbia and Bessone, Weber (39), Dawson and Davie, Dawson and Shaw, Pfahler and Case, and Nix) found the cancer invading both lymphatic and blood vessels. Extensive examination of multiple sections cut from the breasts removed in our cases demonstrated spread through both blood and lymphatic vessels, although predominantly through the latter. It is the peculiar propensity of this type of malignant lesion to spread toward the skin and through the subepidermal lymphatics and this propensity gives it some of its unusual clinical attributes. The presence of carcinoma in the lymphatics of the skin, many of which are blocked, prevents drainage of lymph and causes edema of the skin. Generalized lymphatic involvement throughout the breast produces stasis of lymph and later enlargement of the entire breast.

It is quite likely that stasis also accounts for the redness and discoloration of the breast. Like the edema, the redness tends to disappear when the patient is lying down. Extensive cancer plus inadequate lymphatic drainage produces increased pressure within the



Fig. 8. Evidence of metastasis to the thoracic wall and the opposite breast.

breast and the resultant passive hyperemia. The presence of an increased amount of blood, especially in the subepidermal region, leads to redness and blueness of the skin. When the patient is in the recumbent position the effect of gravity somewhat reduces the amount of stasis and modifies the circulatory findings.

In no instance was there either clinical or pathologic evidence of infection to account for the inflammatory signs in our series of cases. At microscopic examination lymphocytes and plasma cells were often found in the vicinity of the cancer, but no more than in comparable carcinomas without clinical signs of inflammation. Clumps of lymphocytes were also found in the subepidermal tissue as previously described by Learmonth, Ewing (according to Lee and Tannenbaum) and Leitch. The finding of these clumps may indicate that stasis of lymph or possibly a reaction to some irritant product of the carcinoma had occurred.

All observers who have studied inflammatory carcinoma have been impressed with its poor prognosis. Some writers (Lee and Tannenbaum, Geschickter, Pack and Livingston, and White) have felt that palliation is the only hope and that irradiation is the best therapy. Orbach, Leitch, Bloodgood, and Learmonth, however, reported occasional excellent results of surgical treatment. In our series surgical treatment was employed in all cases in which the lesion had not obviously spread beyond the limits of excision. The fact that 3 patients survived for 5 years after operation would seem to justify this type of therapy.

#### SUMMARY

In 74 (1 per cent) of approximately 7000 cases of malignant lesion of the breast, the

diagnosis was inflammatory carcinoma because of characteristic clinical features which simulated those of inflammation. The disease was found to occur in the same general age group as carcinoma of the breast and there was no particular correlation with pregnancy or lactation. The incidence of bilateral malignancy was two times that noted in comparable cases of the usual carcinoma of the breast. The left breast was affected primarily nearly twice as frequently as the right. On examination both breasts were large and often the involved one had become bigger than its mate. The skin over the breasts was red or edematous or both and palpation frequently revealed diffuse infiltration rather than a localized tumor. The axillary nodes were involved in all cases.

Pathologically the lesions were diffuse high-grade adenocarcinomas, which frequently involved the lymphatics and occasionally the blood vessels. Characteristically the cancer spread through the subepidermal lymphatics. There was no evidence of bacterial infection and ulceration of the skin was extremely rare. The inflammatory appearance was apparently due to blockage of the lymphatics by cancer cells and the resultant vascular phenomena.

Prognosis for life is poor but 3 patients lived more than 5 years after operation and 1 was alive 9 years after operation.

The common sites of metastasis were the thorax bone the opposite breast and the skin. Occurrence of metastasis to the skin was especially frequent, having been present in 55 per cent of the cases in which metastasis was known to have occurred.

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# THE EARLY CLOSURE OF CONSTANTLY CONTAMINATED INFECTED WOUNDS WITH THE AID OF URETHANE- PENICILLIN MIXTURES

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**A**BSCESSED, undermined postoperative wound infections are occasionally encountered by the surgeon in spite of improved techniques and antibacterial therapy. If the incision is near the anus or has a colostomy in or adjacent to it, one is confronted with the problem of constant fecal contamination (Fig 1). These wounds are complicated by prolonged hospitalization, painful dressings, loss of protein, and hernias. Frequently the fear of evisceration causes temporization in the usually accepted principle of adequate open drainage. It is the purpose of this preliminary report to show that such wounds can be opened widely surgically closed, and satisfactorily healed within a short period of time in spite of constant contamination.

It has been our observation that infected wounds treated with wide open drainage and subsequent healing by second intention progress much more rapidly and favorably than do those which are treated by means of conservative catheter irrigations or drainage through small openings.

The war literature has clarified and emphasized certain principles of reparative surgery as applied to battle injuries. In general, the accepted treatment for all wounds is a two stage operation consisting of débridement and closure. The optimal time for this closure begins on about the fourth and ends on approximately the tenth day. Early in this period muscle and fascial planes can be sutured but beyond the fourth day the feasibility of

anatomic layer closure diminishes and the need for through and through sutures under cutting and wound excision increases (1). Invasive infection calls for drainage, excision of devitalized tissue, chemotherapy, and moist dressings (2). The severity of the infection dictates the time of closure. Decision to close a wound should be based on its gross appearance. Experience has shown that decision to close a wound based on bacteriological study is impractical, failure having followed the closure of sterile but dirty wounds while 'clean' wounds healing by first intention after delayed closure may show a profuse bacterial flora (2). Thus closure and not sterilization is the primary objective in wound management. Lyons stated that, Suppuration of a wound is believed to be due more to the presence of a pabulum of wound protein than to any specific bacterial virulence. The presence of devitalized tissue prevents or delays the action of antibacterial agents and calls for prompt débridement. It is obvious that surgical débridement is more rapid and effective than chemical methods.

The above outlined principles which have proved successful in the management of war injuries and in the closure of decubitus ulcers have not been widely applied to postoperative wound infections. Although it is not possible to sterilize a wound that is constantly being recontaminated by feces it has been possible with the use of proper surgical measures and the aid of chemotherapeutic and antibiotic agents to convert it into a clean wound and to effect an early surgical closure in the majority of instances in this small series.

Many of the infections reported here are distinguished by the fact that the abscess is discovered after the fourth day and involves the full extent of a closed surgical wound down to the peritoneal layer. A colostomy in or

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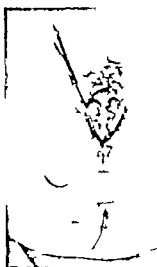


Fig. Infected undermined postoperative wound with retracted colostomy pouring feces into it.

adjacent to the wound may be a constant source of recontamination. The patient is in the older age group and has been debilitated by malignant or chronic disease and an operation. The danger of evacuation is imminent. Invasive infection is often present in spite of previous antibiotic and chemotherapy and calls for the application of moist dressings. For this purpose we have instituted the use of a 10 per cent solution of urethane containing 1,000 units of penicillin per cubic centimeter.

The limited rôle of chemotherapy in the management of wounds has been emphasized and local chemotherapy has been condemned (10). There are many reasons to explain the failure of topical therapy of infected wounds. Among these are the ineffectiveness of the agent in the presence of pus and devitalized tissue, the formation of penicillinase by certain gram negative organisms, the local trauma incident to topical therapy and the inability of available antibacterial agents to sterilize a wound. On the basis of accumulated experience in large series of cases the local use of the sulfonamides in open wounds has been abandoned (3, 11). It is questionable whether a blanket condemnation of all local chemotherapy is justifiable based on experience with the relatively few antibacterial agents that have had adequate clinical trials. Certain agents

such as activated zinc peroxide, normal saline, and hypochlorite solutions are of established value under certain conditions. Few antibacterial agents have had adequate evaluation based on large series of cases comparable to the studies on penicillin and the sulfonamides conducted by the Subcommittee on Surgical Infections and Burns of the National Research Council. There are instances in which systemic antibacterial therapy is impossible or unjustified in ambulatory patients with small lesions. Some form of local therapy is indicated in these cases. Because of inadequate blood supply or scar tissue barrier it is often impossible to secure effective concentration at the site of the lesion by use of a systemically administered drug. Encouraging reports on the use of local antibiotic and chemotherapeutic agents have recently appeared in the literature (5, 6, 12).

The proper treatment of surgical infections demands that the selection of the antibacterial agents be based on the sensitivity of the organisms present in the wound which is being treated. A number of agents are now available each with its own specific indications and contraindications. It is not necessarily a requirement that an antibacterial agent should sterilize a wound to establish its value. It is possible that some of the antibacterial agents now being studied will assume a useful though limited rôle as topical agents in the fight against infection. In cases in which moist dressings are indicated, especially in the presence of frequent fecal contamination, it would seem rational to use a solution containing antibacterial agents capable of modifying the bacterial flora and helping to hold it in check, provided one is available that is not damaging to tissue.

We first used urethane as an antibacterial agent in 1944 after Weinstein and McDonald demonstrated in vitro that this drug was a potent bactericidal agent for gram negative organisms (14). Earlier this year a study of 39 urethane treated patients was reported and the highly specific action of this drug against gram negative organisms was substantiated when it was applied topically to infected wounds in man (8). This specificity suggested that urethane might be advantageously combined with penicillin for theoretically it should

stop the formation of penicillinase by attacking the gram negative organisms and thus enhance the action of penicillin against the gram positive organisms in the same wound. A combination of bacteriostatic quantities of urethane with penicillin has since been shown to bring about a complete suppression of the growth of mixed cultures of *Staphylococcus aureus* and of *Escherichia coli*. No inactivation of penicillin by the urethane or of urethane by the antibiotic agent could be demonstrated (13).

Chemical observations and laboratory data indicate that the occasional gastrointestinal symptoms accompanying urethane therapy are not due to organic toxic changes (7). Over 60 patients have been treated with topical urethane solution either alone or in combination with sulfanilamide or penicillin. Of the first 39 cases reported, 5 patients were treated with 10 per cent urethane solution, 2 with 20 per cent urethane solution and 32 with a combination of 10 per cent urethane and 1 per cent sulfanilamide. We abandoned the use of sulfanilamide in the mixture because the slight synergistic effect demonstrated *in vitro* seemed of no significance clinically and the bacterial flora showed as good a response by using urethane alone (8). We are now using the urethane penicillin mixture unless the culture shows a pure gram negative flora. The 17 patients whose cases are reported were treated with a solution of 10 per cent urethane containing 1,000 units of penicillin per cubic centimeter with the exception of one patient (Case 1) who was treated with 10 per cent urethane alone and another (Case 12) who was treated with a solution of 10 per cent urethane and 1 per cent sulfanilamide. Eight of the 17 patients had an open colostomy in or adjacent to the wound.

#### METHOD

On discovery of the infection wide open drainage culture and débridement are done in the operating room. Abdominal wounds are opened down to the peritoneal layer and all devitalized tissue is excised. Fine steel wire sutures are placed and left untied to be secured in the event of evisceration. Two small catheters are anchored into the wound which is packed with gauze. Surrounding skin



Fig. 2. Case 1. a. Infected postoperative abdominal wound (Miles operation). Note the colostomy presenting in the wound and the intact peritoneum. Wire sutures are in place to be secured in the event of evisceration. Picture taken 6 days after drainage of abscess, débridement of slough and necrotic fascia and constant 10 per cent urethane soaks. The wound is clean and healthy. Drain communicates with the perineal wound beneath symphysis pubis. b. Wound surgically closed around the colostomy 13 days after débridement and urethane therapy and healed as by primary intention. We now believe that such wounds can be closed on the fourth to sixth day.

areas are covered with vaseline strips. An outer sterile dressing is covered with waxed paper. Paregonic or deodorized tincture of opium is given to check colostomy discharge if necessary. Systemic antibacterial therapy is continued as indicated. Urethane penicillin mixture is injected into the catheters every 2 hours in amounts sufficient to keep the wound constantly wet without soaking the surrounding skin. Packs are changed promptly when gross fecal contamination occurs, mask and sterile gloves are used. Otherwise the wound is inspected on the third to the fifth day depending on our estimation as to when it will be ready. This estimate is based on its appearance at the time of débridement. In order to be ready for immediate closure the inspection should be carried out on the operating table to avoid the possible contamination entailed in a dressing on the ward. If the appearance of the wound is not satisfactory further débridement may be indicated, a fresh dressing is applied and treatment is continued.

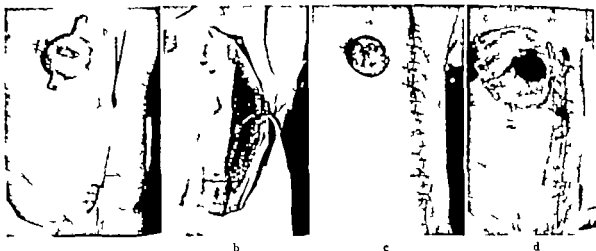


Fig. 3 Case a, Infected undermined abdominal wound with adjacent open draining colostomy. About 5 ounces of thick pus has just been evacuated. b, Wound opened widely in operating room. Debridement to be done.

c, Wound clean and surgically closed after 8 days of treatment with moist dressing of 10 per cent urethane solution containing 10,000 units of penicillin per cubic centimeter d, Primary healing.

The next inspection is carried out after 3 or more days of continued therapy depending on the condition of the wound at the time of the first inspection.

Wounds so treated remain clean red soft and free from green pyocyanous pigment. Closure is usually done under light pentothal anesthesia. If the infection has been discovered early and drainage and débridement promptly carried out it is sometimes possible to do a layer closure after simple freshening of skin margins. Beyond 4 days following drainage and débridement the wound is usually clean but rigid in which case it is excised. It is seldom possible to do a layer closure after excision. Fine through-and-through steel wire sutures are placed about  $\frac{3}{8}$  inch apart and alternate wires may be tied over space obliterating gauze rolls (Fig 4c). The skin is approximated with additional silk sutures. Originally 2 No. 10 F perforated soft rubber catheters were led out through the wound extremities to allow drainage and through which to instill urethane-penicillin mixture for 2 or 3 days. This measure has lately been abandoned. If a colostomy is present a small portion of the wound around it is left unclosed and is packed with gauze saturated with urethane-penicillin mixture.

The following brief case reports are illustrative

CASE 1 (Fig 2) A 50 year old male had a palliative Miles operation for cancer of the rectum on December 17, 1946. Following operation he was given penicillin 50,000 units every 3 hours for 13 days. On the twelfth postoperative day a skin wound infection was detected. A large abdominal abscess connected with the perineal wound beneath the symphysis pubis which was the site of a low grade osteomyelitis. The incision was opened widely down to the peritoneal layer débrided, packed, and treated with constant 10 per cent urethane soaks for 13 days. Culture taken at the time of débridement grew out, *Escherichia coli*, *Bacillus mucosus*, *Proteus morgani* and nonhemolytic streptococci. Adequate supportive therapy in the form of blood transfusions, intravenous fluids, amino acids, and vitamins was given. Intramuscular penicillin therapy was discontinued because of development of sensitivity (arthritis). On the seventh day of treatment when the wound was clean and pink the supply of urethane ran out and saline solution was substituted. The following day the wound was lined with a pyogenic membrane and the dressing was green with pyocyanous pigment, but reverted to its clean pink color within 24 hours after returning to urethane treatment. The discharge from the colostomy which opened directly into the wound (Fig 2a) was kept at a minimum by giving deodorized tincture of opium minima 10 by mouth 4 times a day. On the thirteenth day the wound was closed by excision and undercutting, and with through-and-through fine steel wire sutures. Culture at the time of closure yielded *Pseudomonas pyocyanus*, *Aerobacter aerogenes*, diphtheroids, enterococci, *Clostridium welchii* and pseudotetani. A drain down into the perineal space was led out just above the symphysis pubis. It was removed by the seventh day and its site soon closed over. The wound healed per primam (Fig 2b).

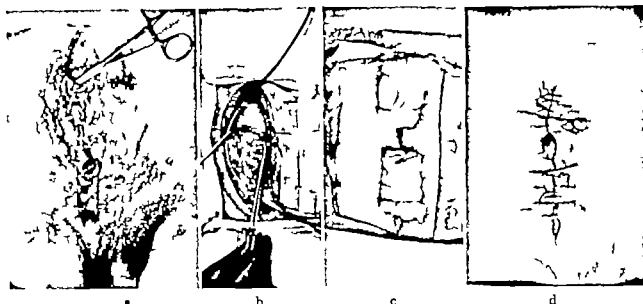


Fig. 4. Case 6. a, Infected postoperative abdominal wound following drainage of an obstructing appendiceal abscess and ileostomy. Kelly clamp indicates ileostomy discharging into and digesting tissues. Peritoneum is intact. b, Wound opened and debrided. Catheters for instillation of urethane-penicillin mixture are in place and gauze pack will be inserted. Attempted ileostomy closure failed. c, Wound surgically closed around ileostomy after 4 days of treatment with 10 per cent urethane solution containing 1,000 units of penicillin per cubic centimeter. Alternate fine steel wires are tied over space obliterating gauge rolls. d, Blood-cotton pack (3) controlling ileostomy discharge is in place. Wound healed by primary intention.

Such patients usually require weeks of hospital care and dressings. Our present belief is that this wound could have been successfully closed on the fourth or fifth day. The development of suppuration when saline solution was substituted for urethane and its reversion to its former clean state after the reinstitution of urethane therapy are evidence of the beneficial action of the drug in this case.

**CASE 2** (Fig. 3). A 64 year old male with mild controlled diabetes not requiring insulin had an infected abdominal wound discovered 21 days after an abdominoperineal sphincter preserving "pull through" operation for cancer of the rectum, and 4 days after an open transverse colostomy done because of retraction of the perineal segment of bowel. On April 28, 1947 the wound was opened widely down to the peritoneal layer and a meticulous débridement was done. Cultures revealed *Escherichia coli* and *Proteus vulgaris*. Two catheters were led out through the extremities of the wound which was lightly packed with gauze. A solution of 10 per cent urethane containing 1,000 units of penicillin per cubic centimeter was injected into the catheters every 2 hours in sufficient quantity to keep the packs constantly wet. Deodorized tincture of opium minims 10 three times a day was given by mouth. On the eighth day of treatment  $\frac{3}{4}$  inch of skin and subcutaneous tissue was excised from the wound margins. The fascia was approximated with interrupted chromic catgut and the wound was closed with through-and-through fine steel wire. The skin was further approximated

with black silk. Culture taken at the time of closure yielded the same organisms and the wound was clean and healthy in appearance.

One catheter was led out of the upper end of the wound through which 10 cubic centimeters of urethane penicillin mixture was instilled every 3 hours for 3 days after which the catheter was removed. The patient received parenteral vitamins B, C and K. Before operation his blood volume studies showed a deficit of 18 cubic centimeters. He received one blood transfusion during his original operation and his hematocrit and hemoglobin remained within acceptable limits without further protein replacement therapy. Soft white healing by primary intention resulted.

In the light of subsequent experience the wound in this case could also have been closed several days earlier. Even on the eighth day it was possible to close the fascia as a distinct layer.

**CASE 6** (Fig. 4). A 51 year old male had drainage of an intra-abdominal abscess secondary to a ruptured appendix on July 28, 1947. Because of small bowel obstruction caused by the abscess and unrelieved by a Miller Abbott tube the surgeon did a double pursestring catheter ileostomy and brought the catheter out through the wound. Eight days post-operatively the wound was opened because of undermining infection and necrosis from the discharge of bowel contents through the everted ileostomy stoma which presented itself in the wound just beneath the skin, the catheter having been extruded. A culture yielded *Escherichia coli*, *Bacillus subtilis* and diph-



TABLE I—EARLY CLOSURE AFTER WIDE OPEN DRAINAGE IN MASSIVE WOUND INFECTIONS

Case No.	Diagnosis	Type of wound infected	Source of contamination	Opening to closure	Healing
	Cancer of rectum	Abdominal (Miles operation)	Colostomy in wound	3 days*	Primary
	Cancer of rectum	Abdominal (abdominoperineal resection)	Adjacent colostomy	8 days†	Primary
3	Carcinomatous intra-abdominal	Abdominal	Colostomy in wound	3 days	Healing expired 5th day
4	Cancer of colon	Abdominal	Adjacent colostomy	1 day†	Primary
5	Cancer of rectum (dehiscence)	Abdominal	Adjacent colostomy	**	Primary
6	Abscess, intraperitoneal (ruptured appendix)	Abdominal	Ileostomy in wound	4 days†	Primary
7	Cancer of cecum	Abdominal (carcinoma exteriorized)	Colostomy in wound	days	Primary
8	Recurrent cancer of colon (intestinal obstruction)	Abdominal	Adjacent colostomy	4 days†	Failure
9	Cancer of transverse colon	Abdominal	Intra-abdominal lactae—fecal fistula	**	Unsatisfactory
	Intestinal obstruction (small bowel)	Abdominal	At dehiscence	days	Primary
	Cancer of cecum	Abdominal	At operation	3 days‡	Satisfactory
	Cancer of cecum	Abdominal	At operation	7 days‡	Satisfactory
13	Cutaneous sinus (inguinal)	Inguinal herniorrhaphy	At operation	3 days	Primary
4	Ruptured appendix	Abdominal	At operation	days†	Primary
5	Breast abscesses (multiple)	Inguinal herniorrhaphy	At operation	**	Primary
6	Compound fracture both bones of leg	Leg (partial closure)	At accident	7 days	Satisfactory
7	Diabetic necros	Perineum	Anus	0 days	Primary

\*Treated with 0.5% urethane solution

†Layer closures

‡Closed at time of drainage and debridement

§Treated with 0.5% urethane 1% sulfadiazide mixture

(Table I) All were surgically closed within less than 14 days after open drainage except 1, an abscess of the perineum which was opened and closed in two stages in 19 days.

There were 15 successful closures and 2 failures. Of the successful cases 11 wounds healed by primary intention with soft white healing. In Case 11 healing was satisfactory but with a small area of granulation tissue at one end of the wound. In Cases 12, 15 and 16 there was slight induration and redness around the wound for several days. For this reason they were not classified as healing by primary intention although the clinical end results were as good as those with true primary healing.

Layer closure was done in 5 instances (Cases 2, 4, 6, 8 and 14).

Of the 13 patients with abdominal wounds 8 had fecal discharge into the wound.

The average elapsed time from opening to closure in all wounds was 7.41 days.

A brief résumé of the 2 failures in our series follows.

CASE 9. A 54 year old single female factory worker had a Mikulicz resection of a carcinoma of the transverse colon and a resection of 25 square inches of her right lateral abdominal wall to which the carcinoma was adherent, on May 25, 1946. She made an uneventful convalescence gained weight and returned to work. On follow-up examination a small nodule was palpable within the colostomy against the lateral abdominal wall. It remained stationary in size for 5 months and it was thought to be scar tissue at the site of plastic closure of the abdominal wall defect. On September 5, 1946 the colostomy was closed at which time the nodule was biopsied and proved to be adenocarcinoma grade II. A fecal fistula developed, persisted for several months, and finally healed. A progressively enlarging mass appeared beneath the incision. In spite of this she remained vigorous and did not lose weight. On June 4, 1947 she presented herself with small bowel obstruction of several days duration. After 10 days of Miller Abbott tube decompression an exploratory laparotomy was done on June 14, 1947. A matted mass of intestines and carcinoma occupied the right half of the abdominal



wound infection and remained firm throughout the course of treatment.

Once having accepted and practiced the principle of wide open drainage for postoperative infections one is confronted with the problem of treatment and closure of an open wound. The necessity for a protective dressing in the face of fecal contamination is obvious and the presence of devitalized tissue or invasive infection calls for the use of moist dressings. The utilization of a solution which contains antibacterial agents seems rational provided these agents are not detrimental to wound healing and are capable of inhibiting the bacterial flora and improving the gross appearance of the wound. If these principles prove successful in the management of wounds bathed in feces they should be even more efficacious in wounds not so complicated. Such has been our experience in the few preliminary cases reported here. The advantage of urethane-penicillin mixture over saline was exemplified in Case 1 in which it seemed obvious that the mixture was helping to hold *Pseudomonas pyocyaneus* in check. Once a postoperative wound infection has been converted to a clean wound it can be treated as any open wound and surgically closed.

The true age of most of these wounds dates from the time of the original operation and not from the time of drainage and débridement. Thus they are not strictly comparable to the war wounds on which the concept of an optimal closure period extending from the fourth to the tenth day is based. From 5 to 7 days has usually elapsed before the infection is discovered and this fact probably explains why layer closure cannot be more often accomplished.

The early closure of infected wounds undisturbed by a source of recontamination has been accomplished without difficulty. At first we were hesitant about closing wounds with feces draining into them but now believe that many of them can be closed on the fourth to sixth day if properly treated. Meticulous attention to detail and faithful nursing care are essential. Although the use of urethane-penicillin mixtures has seemed to be a useful aid in the conversion and closure of these wounds it is not to be thought of as the pre-dominant factor for the application of sound

surgical principles. The correction of anemia and the restoration of tissue proteins are of paramount importance. It is difficult to assess the value of continued systemic antibiotic and chemotherapy when the infection being treated develops despite their prophylactic use.

Case 9 classed as a failure is included even though the problem was not that of treatment of an established wound infection. An attempt was made to use urethane-penicillin mixture as a prophylactic in a contaminated wound. The wound had partly healed when the fecal fistula developed and contaminated it from within a situation with which no antibacterial measures can be expected to cope. The other failure was in a debilitated, depleted 78 year old lady with peritoneal carcinomatosis in whom the usual protein restorative measures were ineffective. It was probably an error in judgment to attempt closure of her wound. This is a true failure attributable to irreversible fault in the processes which influence wound healing.

#### CONCLUSIONS

A method for the treatment of postoperative wound infections is outlined and the need for the use of wide open drainage and careful débridement is emphasized.

A combination of early wide open drainage, proper application of the principles of reparative surgery and topical antibacterial therapy allows conversion of postoperative wound infections with a constant source of fecal contamination into 'clean' wounds which may be surgically closed within a short period of time thus averting many of the complications of wound infections.

Layer suturing may be accomplished early in the optimal period for wound closure.

Urethane-penicillin mixture by virtue of its action upon both gram negative and gram positive bacteria appears to be a useful adjunct to reparative surgery.

Seventeen patients with postoperative infected wounds 8 of whom had a colostomy in or adjacent to the wound have been treated and the wounds surgically closed within an average of 7.41 days after open drainage. There were 2 failures. Primary healing occurred in 15 cases.





# A LARGE PULSION ESOPHAGEAL DIVERTICULUM WITH COMPLICATIONS

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THE report of a single case of large esophageal diverticulum of the pulsion type particularly from a clinic where 270 patients with such diverticula have come to operation could well seem peculiar were it not for the fact that the complications in this case were of such variety and nature that an opportunity presented itself to demonstrate and discuss their management.

## REPORT OF A CASE

A man aged 67 years, complained of difficulty in swallowing which had been present for 40 years. When he was about 26 years of age this difficulty in swallowing began and has gradually become worse until recently he has been able to swallow very little solid food. As he ate a swelling would appear in the anterior left portion of his neck as a result of the accumulation of food within the large diverticular sac. This food caused the patient discomfort and by his exerting external pressure over the mass the food was regurgitated. Patient originally weighed 160 pounds at the time of admission he weighed 127 pounds having lost 30 pounds during the last 2 or 3 years (Figs. 1 and 2).

The patient was seen by the members of the medical department of the clinic who ascertained that 6 weeks before his admission a right sided pneumonia had developed which was treated successfully with penicillin. He has had a chronic mild cough since that time but other than arteriosclerosis, cardiac hypertrophy and auricular fibrillation nothing abnormal was noted in his physical findings. Operation for removal of the diverticulum was advised.

## MECHANISM OF OBSTRUCTION

In previous papers and discussions on this subject<sup>1</sup> attention has been called to the fact that obstructive symptoms in patients with pulsion esophageal diverticula occur only when the sacs have become large enough to pull upon the opening into the esophagus beyond the neck of the sac. Thus the esophagus instead of being in the transverse position so that food passes directly into it on swallowing is converted into a lateral position by the

downward traction of the food filled sac and the opening into the diverticulum becomes transverse so that swallowed food or introduced instruments (esophagoscope or bougie) pass directly into the sac and not directly into the esophagus itself.

This is well illustrated in Figure 1 of the large barium filled sac of the diverticulum. Note in the illustration that the course of descent of the swallowed barium is directly into the sac while the barium spilling over the edge of the transverse opening into the diverticular sac passes into the now lateral opening into the esophagus and is shown as a thin tract of barium. This thin tract is the obstruction and the reason that patients who have large diverticula as in this case do not obtain adequate nourishment and for this reason lose weight.

Two hundred and seventy patients with esophageal diverticula were operated upon at this clinic in 5 of the patients an esophagoscope or bougie had been pushed through the end of the sac at another clinic resulting in mediastinitis. All of these patients have survived 1 required a posterior mediastinotomy, 1 required multiple incisions in the neck and a gastrostomy and all had a very narrow escape from a fatality. In presenting an explanation of this type of obstruction I have always called attention to the fact that since the opening into the true esophagus is at the side of the sac, it is impossible to manipulate an esophagoscope into the true esophagus as it will always go directly into the sac. I wish again to warn those who are inexperienced with esophageal diverticula and unaware of this fact that in those cases in which the opening into the esophagus is lateral the introduction of the esophagoscope or an attempt to pass bougies is extremely dangerous and persistence in pressure after the instrument or the bougie has entered the sac will result in perforation at its end.

From the Department of Surgery, The Lahey Clinic.  
Lahey F. H. Arch. Surg., 1940, 4, 1118-1140.



Fig. 1. Roentgenogram showing the size of the diverticulum. One can perceive in diverticulum of this depth that the parietal pleura becomes adherent and encloses the sac and that as occurred in this case there is the danger of tearing it as the sac is separated from it.



Fig. 2. Not the diagnostic point that is true of all lateral view of esophageal diverticula, that the stream of barium passing to the esophagus comes from behind and from the upper part of the sac and not from the most dependent portion of the sac.

#### RUPTURE OF THE PLEURA IN DELIVERING THE SAC FROM THE CHEST

It must be remembered that when the sac of the diverticulum is as large as it was in the present case (Figs. 1 and 2) the lower portion of the sac will be enveloped by and adherent to the pleura; that the pleura is a delicate structure and that as the sac is pulled out of the chest and the pleura freed from it there will be danger of tearing the adherent pleura, a unwittingly occurred in this case with such immediate effect upon the mechanism of breathing that cessation occurred.

Since intratracheal cyclopropane anesthesia was used in these patients no serious difficulty was encountered; the anesthesiologists were able to continue respiration mechanically by means of the breathing bag. It was not until the sac was completely delivered that the wide rupture in the apex of the pleura with its partly collapsed lung beneath it could be demonstrated as the cause of the respiratory difficulty. The introduction of a large wet pack into the

opening of the pleura to plug it temporarily permitted the restoration of respiration and closure of the pleural rent was delayed until the diverticular sac was completely dissected at its neck and ready for implantation in the wound at the completion of the first stage of the operation.

Before the wound in the neck was closed the wet pack was withdrawn from the opening in the pleura; the anesthesiologist expanded the lung by positive pressure and the torn edges of the ruptured pleura were without difficulty approximated by interrupted sutures of fine silk. A cigarette drain with a large strip of gauze projecting from its end was placed in the mediastinum; the sac was implanted in the wound and the skin was closed about it as is the custom in the two stage operation. A No. 24 F catheter was then introduced into the pleural cavity between the fourth and fifth ribs through a trocar; the lung was expanded by suction upon this catheter and the end of the rubber tubing connected with it was carried

into a bottle of water below the level of the patient (Fig 3). This catheter was removed in 48 hours; there was no further collapse of the lung. The drain into the mediastinum was removed on the sixth day with no further pulmonary collapse. There were no further complications as the result of the rupture and suture of the pleura.

Whatever our position may be regarding one or two stage operations in pulsion esophageal diverticula, and my favoring of the two stage operation is too well known to require repetition; its safety and advantages in a case such as this must be admitted. It is my opinion that the dangers of mediastinitis in the one stage operation are greatly increased in patients with large diverticular sacs since in these large sacs the opening into the esophagus where the sac joins that structure is large and its accurate suture and inversion difficult and uncertain. It is also made more dangerous by the very large cavity which remains in the mediastinum after removal of such large sacs from their position in the chest. It must be remembered that the neck of the diverticulum usually enters the esophagus in the midline in back—at the pharyngo-esophageal junction—that at this level where the esophagus joins the pharynx, the esophagus cannot be freely mobilized or rotated, and that adequate exposure and accurate suture of the esophagus after the sac is cut away is often extremely difficult and frequently far from accurate, thus exposing these patients to the risks of leakage and contamination of so deep an intrathoracic cavity. This is not to be feared when the sac is not cut away and its neck sutured into the wound. By this plan the mediastinal cavity and fascia planes become walled off by protective granulations and adhesions and should leakages occur at the second stage amputation and closure of the sac they will not result in serious complications.

#### OVERDISTENTION OF THE IMPLANTED SAC BY SWALLOWED AIR

Ballooning of the sac (Fig 4) is caused by the swallowing of air. We have seen this complication in several patients with large sacs after implantation in the neck and after the wound has been sutured about it. Continued



Fig 3 This roentgenogram shows the catheter which was introduced into the right chest between the fourth and fifth ribs to re-expand the lungs after the pleura, torn at the time of operation, had been sutured. On the left side note the outline of the sac, as indicated by arrows, shown in a later illustration distended by air when it was implanted on the neck.

accumulation of air within the sac increases its volume and if distention is continued, gangrene of the sac will follow. As the result of the traction of the neck of the distended sac upon the esophagus itself, lateral traction exerted upon the esophagus will cause complete obstruction and interference with the intake of an adequate amount of fluid and nourishment.

Distention of the sac is immediately relieved by the introduction of a decompressing catheter by means of a pursestring suture into the sac (Fig 5). At the end of 3 or 4 days when the wound has healed about the neck of the sac, the excess sac may be cut away (Fig 6).

#### THE PROBLEM OF FEEDING THE PATIENT BETWEEN STAGES

In the present case because the diverticular sac was so large, together with the fact that the pleura had been opened and sutured, and also because following the delivery of the sac from the mediastinum, there remained a large mediastinal cavity, the problem of feeding the



Fig. 1. Roentgenogram showing the size of the diverticulum. One can appreciate in the diverticulum of this depth that the pleural sac becomes adherent to and envelops the sac and that as occurred in this case, there is the danger of tearing it as the sac is separated from it.



Fig. 2. Note the diagnostic point that is true of all lateral diverticulae, that the stream of barium passing into the esophagus comes from behind and from the upper part of the sac and not from the most dependent portion of the sac.

#### RUPTURE OF THE PLEURA IN DELIVERING THE SAC FROM THE CHEST

It must be remembered that when the sac of the diverticulum is as large as it was in the present case (Figs. 1 and 2) the lower portion of the sac will be enveloped by and adherent to the pleura so that the pleura is a delicate structure and that as the sac is pulled out of the chest and the pleura freed from it there will be danger of tearing the adherent pleura, as unwittingly occurred in this case with such immediate effect upon the mechanism of breathing that cessation occurred.

Since intratracheal cyclopropane anesthesia was used in these patients, no serious difficulty was encountered; the anesthesiologists were able to continue respiration mechanically by means of the breathing bag. It was not until the sac was completely delivered that the wide rupture in the apex of the pleura with its partly collapsed lung beneath it could be demonstrated as the cause of the respiratory difficulty. The introduction of a large wet pack into the

opening of the pleura to plug it temporarily permitted the restoration of respiration and closure of the pleural rent was delayed until the diverticular sac was completely dissected at its neck and ready for implantation in the wound at the completion of the first stage of the operation.

Before the wound in the neck was closed the wet pack was withdrawn from the opening in the pleura, the anesthetist expanded the lung by positive pressure and the torn edges of the ruptured pleura were without difficulty approximated by interrupted sutures of fine silk. A cigarette drain with a large strip of gauze projecting from its end was placed in the mediastinum; the sac was implanted in the wound and the skin was closed about it as is the custom in the two stage operation. A No. 24 F catheter was then introduced into the pleural cavity between the fourth and fifth ribs through a trocar; the lung was expanded by suction upon this catheter and the end of the rubber tubing connected with it was carried

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Fig. 4.

Fig. 5.

Fig. 6.

Fig. 7.

Fig. 4. Photograph of patient showing the distention of the sac with air swallowed by the patient. This complication occurred between the first and second stages of the operation and made necessary decompression, as shown in Figure 5.

Fig. 5. The same sac as shown in Figure 4, after decompression by the introduction of catheter.

Fig. 6. This view was taken after the major portion of

the sac had been amputated at the end of the fourth day thus permitting the manual introduction of catheter through the neck of the sac into the esophagus and then on into the stomach. The patient was fed through this catheter until he was ready for the second stage removal of the sac.

Fig. 7. The wound is completely healed after the sac has been completely cut and sutured at its neck.

patient between the first and second stages of the operation became a difficult one consequent distortion of the course of the true esophagus made it impossible for the patient to swallow.



Fig. 8. A roentgenogram of the esophagus showing the final stage with the sac completely removed, the wound closed, and no defect remaining.

Since there remained a large mediastinal cavity at the bottom of which was a large recently sutured rent in the pleura it seemed wise not to do at the usual time 7 days after the first operation the second stage of operation namely the reopening of the wound in the neck the severing of the sac at its neck and the suturing of the remaining opening in the esophagus but to wait 2 weeks until the rent in the pleura was well healed and the large mediastinal cavity largely obliterated.

The feeding problem was easily handled in this case by cutting away the excess walls of the sac at the end of the fourth day when the walls of the implanted sac were firmly adherent to the wound in which the sac had been implanted and when the overdilated sac had been decompressed by the introduction of a catheter. Through this large aperture opening directly into the esophagus a Levine tube could easily be guided by the finger directly into the stomach. Through this tube the patient was fed without difficulty until ready for the second stage of the operation the removal of the remainder of the sac and the suture of the defect made in the esophagus by the cutting away of the neck of the sac (Fig. 6). With closure of the esophagus at the second stage operation and with wide exposure by reopening the original longitudinal incision in the neck by complete separation of the remaining implanted neck of the sac from the

edges of the wound together with complete mobilization of the esophagus itself up to the point where the sac joined the esophagus, an accurate inversion suture in two rows of the open edges of the esophagus could be made. As is our custom a tube was passed through the nose into the stomach and the patient was fed for a week through this, at the end of which time the tube was removed. There was no leakage the reopened wound had healed without difficulty (Fig 7) and the patient was swallowing well. The roentgenogram (Fig 8) shows that there is no remaining sac or obstruction.

It can be said of course that had this operation been done in one stage with immediate amputation of the sac and immediate closure of the opening into the esophagus made by the removal of the sac some of the complications mentioned here would not have occurred such as overdistention of the sac with air the need to decompress it, and the need to feed the patient by tube for the 15 day period between the first and second stages of the operation. Whatever one may think of one or two stage operations in patients with esophageal diverticula if one has done many of them he must admit that in a patient in whom the pleura has

been opened and sutured at the bottom of a cavity of such dimensions as present in this patient, the likelihood of a leak at the suture line in the esophagus would have been greatly multiplied. Whatever may be said about the relationship in this case of the complications to the two stage procedure, the two stage plan did make possible the successful safe handling of the complications without leakage and mediastinal infection.

#### SUMMARY

A case is presented of a large esophageal diverticulum which had a large intrathoracic sac.

The following complications occurring during the operation and their management are discussed: rupture of the pleura during the operation and its repair; overdistention of the implanted sac requiring decompression; partial amputation of the sac and introduction of a tube through the neck into the stomach; delay in second stage to permit healing of the pleura and the obliteration of the mediastinal cavity.

Roentgenograms and photographs are shown to illustrate some of the complications and the method of management.



# CHEMOTHERAPY IN PERITONITIS DUE TO PERFORATION OF AN ABDOMINAL VISCUS

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THE use of the sulfonamides penicillin and streptomycin has done much to improve the results obtainable in the treatment of peritonitis secondary to contamination from the alimentary tract. Peritonitis of this type usually results from a perforation of some portion of the gastrointestinal tract from trauma from infection or from contamination during a surgical procedure. The infection is usually mixed but the predominant causative organism is most often the colon bacillus.

The sulfonamides are not considered effective against the colon bacillus but are of considerable value in combatting numerous other organisms in the mixed infection group. However, sulfasuxidine and other sulfonamides are effective in reducing the *Escherichia coli* count of the stool when given orally and it would seem that they would also be effective against the same organism in peritonitis.

Penicillin in its usual dosage is not effective against this type of peritonitis. However, in massive doses it adequately controls these mixed infections. Just how this is accomplished is still not definitely determined but the conclusions reached by Crile (4, 5) seem very logical. *Bacillus coli* and other penicillin-resistant organisms produce penicillinase which is an enzyme-like substance capable of inactivating penicillin. Usual doses of penicillin are not capable of overcoming this penicillinase effect of the *Bacillus coli* but when large doses are given this effect is overcome. Then penicillin becomes effective against the virulent gram-positive cocci although it theoretically does not inhibit the colon bacillus. This organism and most of the penicillin-resistant organisms are not virulent or invasive and can be combatted effectively by the high natural resistance of the peritoneum when the virulent gram-positive cocci are controlled.

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Therefore it is important that adequate amounts of penicillin be given early and continued for a sufficient length of time.

Streptomycin acts primarily on the gram-negative organisms and is effective in adequate dosage in peritonitis due to *Bacillus coli* but is not as effective as penicillin on other members of the mixed infection group. A disadvantage to streptomycin is that the toxic reactions are relatively frequent and permanent whereas those to penicillin are minor and temporary.

The cases of this type of peritonitis during a 12-month period are presented with the amount of drug or drugs used and several important factors in treatment are discussed. We will also present what we consider an adequate chemotherapeutic regimen in peritonitis due to contamination from the gastrointestinal tract.

## DISCUSSION

In reviewing the cases presented (Table I) several interesting conclusions can be reached regarding the value of chemotherapy in this type of peritonitis.

In cases in which the peritonitis was early and in which no purulent exudate was present in the peritoneal cavity the dosage of penicillin needed was much smaller than in more advanced cases. This was evidenced in Cases 1, 2, 10, 13, and 15. It is probable however that even in these cases the initial dosage should have been greater because it is very important to obtain and maintain a high concentration of the drug at the onset.

In several of the cases 200,000 units of penicillin were left in the peritoneal cavity. We feel that this is a valuable adjunct to parenteral therapy for it provides a high concentration at the site of contamination. Sulfathiazole crystals were left in the peritoneal cavity in several cases and we think that it was of some value in combatting the mixed infections. Never more than 5 grams were used.

and that was distributed carefully so that there was no lumping or caking of the crystals which would provide a large foreign body in the peritoneal cavity

Sulfonamides were never used alone but always in combination with penicillin or streptomycin or both. In some of our cases they were not used at all, and the results were apparently not altered by the absence of the sulfonamides. Nevertheless, in cases of mixed infection, we do not feel that it can be omitted

In several of our cases, streptomycin was used in moderate dosage although it may have been unnecessary in some instances. It was used initially in 3 cases of fulminating peritonitis (Cases 5 and 19) and was started on the second or third postoperative day in 4 cases (Cases 6 11 12 and 18) when there was still a sustained temperature elevation. The response in all cases was satisfactory.

One fact that needs emphasis is that prompt surgical intervention is necessary to eliminate the source of contamination to the peritoneal cavity. The exception to this is of course an instance in which the peritonitis appears to be well localized. Even in such a case surgical intervention may be necessary to deflate the bowel if there is an obstruction (Cases 6 and 16) or to provide adequate surgical drainage. In some instances of ruptured appendices where the peritonitis was well localized with definite abscess formation, it was not feasible to remove the appendix at the time of incision and drainage. In these cases the appendix was removed later when all infection had subsided. Occasionally the appendix will be free in the abscess cavity and can be removed with no danger of spreading the infection.

An interesting fact was illustrated in Case 11 in which the penicillin dosage was decreased too soon, and there was an increase in the temperature elevation and also evidence of increased peritoneal irritation. The penicillin dosage was increased to the original amount and streptomycin was begun. The end result was satisfactory, but several days were added to the hospital stay.

Our conclusions as to the dosage of these chemotherapeutic agents are as follows:

1. In early peritonitis with little contamination of the peritoneal cavity 200,000 units of

penicillin are left in the peritoneal cavity. Then 100,000 units intramuscularly are given preoperatively and every 2 hours postoperatively for 10 to 12 doses. If by that time the temperature and the peritoneal signs are normal, the dosage is reduced to 100,000 units every 3 hours for 8 doses and then 50,000 units every 3 hours for another 48 hours.

The sulfonamides are not used ordinarily in this type of case and streptomycin is reserved for use if it appears that the penicillin is not accomplishing satisfactory results. This can usually be determined within 24 to 36 hours.

2. In cases of localized peritonitis with abscess formation both penicillin in dosage of 50,000 to 100,000 units intramuscularly every 3 hours and sulfonamides in usual dosage either by mouth or intravenously are given both preoperatively and postoperatively. If contamination of the general peritoneal cavity is known or suspected after incision and drainage of the abscess, the penicillin dosage should be 100,000 units every 2 hours for as long as is necessary.

Penicillin and sulfonamides are both of value locally in the abscess cavity—200,000 units of the former and not over 5 grams of the crystalline form of the latter being the recommended dosage. In certain instances, it may be feasible to irrigate the abscess cavity with a solution of penicillin.

Streptomycin is reserved in these cases as in the first group for use if the penicillin and the sulfonamides seem inadequate.

3. In cases of advanced peritonitis where there is gross contamination of the peritoneal cavity with a purulent exudate present, we feel that all three drugs should be used as long as is necessary in adequate dosage as follows:

a. Penicillin 100,000 units intramuscularly every 2 hours with 200,000 units left in the peritoneal cavity at operation.

b. Streptomycin 0.1 gram to 0.3 gram every 3 hours in the usual case or as much as 0.5 gram every 3 or 4 hours in more severe cases.

c. Sulfonamides in usual dosage either by mouth or intravenously—usual dosage being approximately 1 to 1.5 grams every 4 hours. The crystalline form of the sulfonamides not exceeding 5 grams in amount may be used in the peritoneal cavity.

TABLE I.—SUMMARY OF CASES

File No Case	Age Race Sex	Diagnosis	Operations	Hospital course	Chemotherapy—results
1,705	4 White Male	Ruptured duodenal ulcer. Generalized peritonitis, early	Repair of ruptured duodenal ulcer	Satisfactory. No complications. Discharged in good condition on the 5th postoperative day	Penicillin, 11,000 units I.M. every 3 hours for 3 days. Intravenous sodium sulfadiazine 5 gm. daily for 5 days. Satisfactory result.
14,707	8 White Female	Ruptured appendix. Early peritonitis, generalized	Appendectomy. In-out drainage	Temperature 100° to 101° F. for 3 days. Discharged in good condition on the 6th postoperative day	Penicillin, 11,000 units I.M. every 3 hours for 3 days. Sodium sulfadiazine 5 gm. q. 6 h. in intravenous places in N/S—satisfactory result.
108,805	46 White Female	Ruptured appendix. Localized peritonitis and abscess formation	Ligation and drainage of appendiceal abscess. Appendectomy	Admitted with diagnosis of pelvic abscess of appendiceal origin. Treated conservatively with chemotherapy for one week—then incision and drainage of appendiceal abscess with removal of sloughed off appendix. Postoperative course for 3 days. Discharged in good condition on 11th postoperative day	Penicillin, 20,000 units every 3 hours for 5 days. Sulfadiazine in usual dosage. Satisfactory result.
104,86	4 White Male	Ruptured appendix. Generalized peritonitis (perforated)	Appendectomy with drainage	Stomach came with temperature 101° to 102° for 8 days. Poor nutritional status. Inadequate opportunity. (lost weight). Discharged in good condition on the 20th postoperative day	Penicillin, 11,000 units I.M. every 3 hours for 3 days—then 20,000 units I.M. every 3 hours for 3 days. Sodium sulfadiazine intravenously in usual dosage for colic. Satisfactory result.
14,137 5	1 White Female	Generalized peritonitis with multiple abscess formation. Pericolic abscess. Subphrenic abscess (drained previously). All of 4 weeks' duration on admission to this hospital and secondary is appendicitis and peritonitis with appendectomy	Appendectomy (done elsewhere prior to admission to our service). Incision and drainage of subphrenic abscess (done elsewhere prior to admission to our service). Exploration for possible abscess in pelvic region	Very poor condition on admission here. Temperature elevation 101° to 102° but gradually dropped to normal on the 14th day. Numerous transudates of plasma and whole blood gross. General condition as apparent very satisfactory when the developed a following hospital. 10th minor abscess which progressed rapidly. Patient expired 11th 48 hours on the 14th hospital day	Penicillin, 100,000 units every 4 hours for about 6 weeks. Streptomycin 1 gm. every 4 hours for about 1 month. Sulfadiazine in usual dosage for 3 to 4 weeks. Patient expired on 14th hospital day. Autopsy revealed cases of death to be general yellow atrophy of liver. Peritonitis had completely cleared and only numerous peritoneal adhesions remained.
1,007 6	6 White Female	Ruptured diverticulum of sigmoid with complete intestinal obstruction and localized peritonitis	Cecostomy. Segmentectomy	Was stuporous prior to operation and in poor condition, however responded satisfactorily after defecation of the bowels. Temperature spiked to 101° for 3 days and gradually returned to normal by the 6th postoperative day	Penicillin, 100,000 units every 4 hours for 6 days; then 100,000 units every 4 hours for 3 days. Streptomycin 1 gm. every 4 hours for 3 days. Sulfadiazine in usual dosage. Patient responded. It was discharged for 9 months and returned for closure of the cecostomy with satisfactory results.
104,30	47 White Male	Perforated duodenal ulcer. Early peritonitis	Repair of perforated duodenal ulcer	Postoperative course was quite satisfactory until 10th postoperative day when he developed mild respiratory infection that responded to penicillin by inhalation. Temperature on average 100° and was normal on the 6th day	Penicillin, 100,000 units every 4 hours for 6 days—and penicillin via nebulizer for 4 d. Patient responded readily to treatment and was discharged in good condition on the 13th postoperative day
4,906 8	White Male	Appendiceal abscess	Ligation and drainage of appendiceal abscess	Postoperative course was unremarkable. Considerable drainage for 2 weeks. Temperature was 101° to 102° for 3 days and then gradually became normal on the 21st postoperative day	Penicillin, 30,000 units every 3 hours for 7 days. Sulfadiazine in usual dosage. Patient responded readily and was discharged on the 21st postoperative day. Returned 4 months later and an appendectomy was done
14,136	3 White Male	Ruptured appendix. Generalized peritonitis. Subphrenic abscess	Appendectomy with drainage. Incision and drainage of subphrenic abscess. Exploration of drainage tract of subphrenic abscess	Patient was maintained temperature elevation of 102° to 103° for 4 days which gradually became normal on the 17th day. Subphrenic abscess was drained on the 17th and 18th days	Penicillin, 100,000 units intramuscularly every 4 hours for 1 week. Penicillin 10 to 15 mg. in subphrenic abscess cavity. Sulfadiazine in usual dosage. Discharged in good condition on the 20th postoperative day
73 10	46 White Female	Ruptured appendix. Generalized peritonitis, early	Appendectomy. In-out drainage	Prolonged temperature elevation to 102° F. for 3 d. Normal on 6th postoperative day	Penicillin, 40,000 units every 4 hours for 6 days; then 30,000 units every 4 hours for 7 days. Sulfadiazine in usual dosage for 8 days. Discharged in good condition on the 13th postoperative day

TABLE I.—SUMMARY OF CASES—Continued

File No. Case	Age Race Sex	Diagnosis	Operations	Hospital course	Chemotherapy—results
5,468 11	White Male	Ruptured appendix. Generalized peritonitis, purulent	Appendectomy with drainage	Temperature of 101° gradually dropped to normal on the 2nd postoperative day. Rose again on the 3rd day and remained between 101° and 102° for 5 days; then became normal and remained so	Penicillin, 100,000 units every 4 hours for 5 days. Then 50,000 units every 4 hours. Sulfadiazine in usual dosage. Streptomycin 1 gm. every 3 hours—for 7 days—started on 6th postoperative day at height of second temperature rise. Discharged in good condition on 8th postoperative day
145,128	40 White Male	Ruptured appendix. Early peritonitis, localized	Appendectomy without drainage	Temperature elevation 101° to 102° for 3 days. Normal on 3rd postoperative day. Discharged in good condition on the 6th postoperative day	Penicillin, 50,000 units every 4 hours for 5 days. Sulfadiazine in usual dosage. Streptomycin 1 gm. every 3 hours for 3 days. Satisfactory result
145,708 13	30 White Male	Perforated duodenal ulcer. Early peritonitis, generalized	Repair of perforated duodenal ulcer	Smooth course—no temperature elevation. Discharged in good condition on 6th postoperative day	Satisfactory result
145,684 4	34 Colored Male	Ruptured appendix with localized abscess. Peritonitis, generalized	Incision and drainage of appendiceal abscess	Temperature elevation 100° to 101° for 3 days. Normal on 6th day. Discharged in good condition on the 6th postoperative day to return in 6 weeks for an appendectomy	Penicillin, 50,000 units every 4 hours for 9 days. Satisfactory result
78,18 5	White Male	Ruptured duodenal ulcer. Early peritonitis, generalized	Repair of ruptured duodenal ulcer	Temperature elevation 101° to 102° for 4 days. Due in part to flare-up of chronic bronchitis which responded readily to penicillin via nebulizer. Discharged in good condition on 10th postoperative day	Penicillin, 50,000 units every 4 hours for 9 days. Satisfactory result
64,057 6	48 White Male	Intestinal obstruction (colon) due to ruptured diverticulum. Localized peritonitis. Diabetic mellitus	Appendectomy. Appendectomy	Quite ill on admission with marked bowel distention. Satisfactory postoperative course. Improved peritoneal cavity. Discharged in good condition on 3rd hospital day	Penicillin, 50,000 units every 4 hours for 8 days. Local irrigation of peritoneal cavity with penicillin solution. Sulfadiazine in usual dosage when oral medications could be taken. Satisfactory result
6,028 7	49 White Female	Perforation of rectum. Generalized peritonitis	Repair of perforation of rectum. Colectomy	Extremely ill—shock. Peritoneal cavity grossly contaminated with fecal material. Sustained temperature elevation of 100° to 101° for 4 days. Discharged in good condition on the 14th postoperative day	Penicillin 500,000 units left in peritoneal cavity. 50,000 units every 4 hours I.M. for 5 days, then 100,000 units every 4 hours for 7 days. Sulfadiazine crystals 5 gm. in peritoneal cavity. Sulfadiazine in usual dosage. Patient was discharged in good condition and returned 2 months later for closure of colectomy
97,158 8	14 White Female	Ruptured appendix. Early peritonitis, generalized	Appendectomy without drainage	Temperature 100° to 101° for 4 days; then normal. Discharged in good condition on the 11th postoperative day	Penicillin 500,000 units left in peritoneal cavity. Penicillin 100,000 units every 4 hours for 5 days. Streptomycin 0.1 gm. every 4 hours for 4 days. 2.5 gm. sulfathiazole crystals left in peritoneal cavity. Sulfadiazine in usual dosage. Satisfactory result
46,480 9	Colored Male	Ruptured appendix, walled off. Paralytic ileus due to infection	Appendectomy without drainage	Admitted to hospital in state of shock—abdomen very rigid. Temperature 101° to 102° for 4 days. Temperature rose to 103° after operation. Temperature gradually fell to 100° and became normal gradually on the 6th postoperative day. Discharged in good condition on the 11th postoperative day	Penicillin 500,000 units in I.V. glucose in normal saline prior to operation. Streptomycin 1 gm. every 4 hours for 3 days. Sodium sulfadiazine 5 gm. in I.V. glucose b.i.d. for 6 days. Satisfactory result
45,664 20	68 Colored Female	Ruptured appendix with abscess. Generalized peritonitis, purulent, late	Incision and drainage of appendiceal abscess and generally contaminated peritoneal cavity	Admitted to hospital with marked distention of abdomen, tenderness and rigidity. General condition poor. Temperature 101° to 102° for 4 days. Temperature rose to 103° and became normal. Has had wound, therefore purulent drainage. General condition good	Penicillin 500,000 units in peritoneal cavity. 100,000 units every 4 hours I.M. for 10 days then 50,000 units every 4 hours for 7 days. Streptomycin 0.1 gm. every 4 hours for 9 days. Sodium sulfadiazine 5 gm. in peritoneal cavity to operation. Result satisfactory. Patient will have appendectomy at later date

NOTE: Some abscesses, perforated, adequately sealed off at operation by portion of the omentum were not included since the host containing the peritoneal cavity. Prophylactic chemotherapy was used in some of these cases.

General Comments	History taken at later date
<p>Note.—Several cases of acute appendicitis, perforated, adequately sealed off at operation by portion of the omentum were not included since the appendix and the involved omentum were removed without contaminating the peritoneal cavity. Prophylactic chemotherapy was used in some of these cases.</p>	

## SUMMARY

- 1 The effectiveness of chemotherapy in peritonitis secondary to contamination from the alimentary tract has been discussed.
- 2 A chemotherapeutic regimen for this type of peritonitis has been outlined.

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# THE TREATMENT OF ACUTE RENAL INSUFFICIENCY

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A SERIES of different conditions are associated with acute bilateral renal damage and acute renal insufficiency. The syndrome resulting from this type of renal lesion has been designated by different terms such as 'renal anoxia syndrome' (18), 'lower nephron nephrosis' (14) and 'hemoglobinuric nephrosis' (20). It has been frequently stressed in various publications that once renal insufficiency is definite the mortality rate in this group of cases is very high. Thus, Lucké placed the mortality rate near 90 per cent and Mallory stated that with persistent oliguria and hypertension the chance of survival was not much more than 20 per cent.

From a clinical viewpoint it appears that the most common condition associated with this lesion is that of prolonged hypotension particularly that due to oligemia. In a general hospital one may encounter such cases following copious hemorrhages as in traumatic operative and obstetrical cases. It was the frequency of circulatory failure in the various conditions associated with acute renal insufficiency that led Maegraith and coworkers (17) to the conclusion that renal anoxia constituted the main cause of the renal lesion. Other conditions associated with similar renal changes include incompatible (hemolytic) blood transfusions (27), the crush syndrome (2), blackwater fever (5), burns (8), severe alkalosis (21, 23), carbon tetrachloride poisoning (29), heat stroke (19), sulfonamide intoxication (7), severe pyrogenic reaction (1) and transurethral prostatectomy with water hemolysis (4, 22).

In reported cases there has been a frequent attempt to stimulate the kidneys to produce urine during the oliguric period. A common measure used for this purpose has been a prominent fluid intake with or without added salt. In many cases generalized edema and acidosis have been outstanding features of the syndrome, pulmonary edema being striking

Most patients have expired within 8 days (14). Morphologically it has been noted that regeneration of renal tubules is well advanced by the eighth to twelfth days (14, 18, 20, 27). Patients surviving this interval frequently recover. Whether most patients can be sustained through this interval without the aid of artificial measures such as peritoneal irrigation (6) or the Kolff artificial kidney for *in vivo* dialysis (13) becomes a very pertinent question. It is our belief that much of the high mortality can be ascribed to the management used and that therefore this question should be answered in the affirmative. It is proposed to present additional evidence supporting such a stand in the form of 3 closely studied previously unreported cases with severe renal insufficiency: 2 following incompatible blood transfusions and 1 following a prolonged operation and hypotension.

## CLINICAL COURSE

As previously discussed (27) the clinical course of such cases may be divided into 3 phases.

**Phase 1** This is the phase during which renal damage apparently occurs (18, 24, 27, 31). The most common single happening at this time is that of hypotension or circulatory failure. In compatible transfusion cases this is the phase of acute onset with hemolysis (hemoglobinemia—hemoglobinuria). In the latter event hypotension may be transient but frequently is prominent (27). The hypotension may be associated with mental signs of the shock state (26) or the patient may be quite lucid throughout. In operative cases the anesthetic naturally obscures this latter clinical manifestation.

This is a short lived phase lasting a few hours at most, as the immediate recovery from this phase depends on the recovery from the hypotension or shock state.

**Phase 2** The second phase is that of renal insufficiency. Oliguria (or anuria) and azotemia are the outstanding manifestations during

ing this period. In association with the oliguria and azotemia major abnormalities occur

a. **Urinary findings** Anuria is an infrequent finding in cases without additional complications. The oliguria is very pronounced in severe cases but is seldom fixed in amount. In most cases without water salt overload or other complications there is a gradual increment in the urinary volume during the first 5 to 8 days. Then there usually occurs more prominent daily increments in the urinary output and a peak in the diuresis occurs between the eighth to fourteenth days (average twelfth day)

The urine specific gravity soon becomes fixed at a low range (often 1.005-1.010). The solid output in the urine is very low. Thus the urine urea concentration may be lowered to 10 to 20 per cent of normal and the urinary chloride concentration becomes fixed at low levels. This renal inability to excrete salt has much implication. The combination of oliguria and hyposthenuria makes for negligible renal clearance during this phase.

During the first few days (usually 3 to 5) the urine contains pathologic ingredients. Proteinuria may be quite prominent early being as high as 500 to 1000 milligrams per cent and lowering gradually. The presence of intact red blood cells is not unusual and white cells are usually seen in varying numbers frequently clumped. Casts may be prominent early and are usually granular. Degradation products of hemoglobin or myoglobin may occur within casts depending on the type of case. The heme casts gradually decrease in number during the first week after an incompatible transfusion.

The reaction of the urine is usually acid.

b. **Blood and serum findings** Azotemia becomes prominent early. It is not unusual for the blood urea concentration to reach 80 to 100 milligrams per cent during the first 2 days and to attain a peak of 300 to 400 milligrams per cent within 5 to 7 days. At the same time there is a distinct tendency toward acidosis as indicated by a decline in the plasma bicarbonate concentration. The blood chlorides and serum sodium concentration are lowered. The hyponatremia may be quite prominent despite a substantial intake of sodium bicarbonate

(see Case 1). The serum potassium concentration may be moderately elevated early particularly in hemolytic transfusion cases, but in our experience has seldom been very high. Again a moderate intake of potassium is not necessarily attended by a prompt rise in the serum potassium concentration (see Case 1). There are mechanisms therefore that tend to lower the serum sodium and potassium concentrations even with additional intakes of these ions and in the absence of hydremlia. Also the hyponatremia and hypochloremia are not necessarily of similar proportions. A significant lowering of the calcium concentration has not been observed in uncomplicated cases. The patients developing this lesion are not infrequently anemic most often a blood loss anemia.

In hemolytic transfusion cases the hemoglobinemia and hemoglobinuria recede during the first 36 hours. The demonstration of met-hemalbumin in the serum by spectrophotometric analysis is considered as clearcut evidence of prominent intravascular hemolysis. An elevated serum bilirubin concentration (or icterus index) may be demonstrated during the first 2 days (Case 2). An additional evidence of incompatible hemolysis is gained by the demonstration of a rising titer of antibodies against cells of the type transfused. The existence of the various orders of antibodies (first second and third) (10) should be searched for in such studies.

c. **Clinical appearance** There can be little doubt that the clinical appearance of the patient during the first week is greatly influenced by the type of management (27). Patients without added complications particularly water or water salt overload and acidosis, in our experience have not developed the prominent cerebral signs as frequently described. Mental clarity has been observed repeatedly despite severe grades of oliguria for 5 to 8 days. At times, however, the more severe cases have displayed slight mental dullness. Coma or rational loud talk, muscular twitchings and convulsions have been complications in overhydrated cases. Moderate hypertension is a common finding during the renal insufficiency phase. More striking elevations in the blood pressure have been observed in patients with

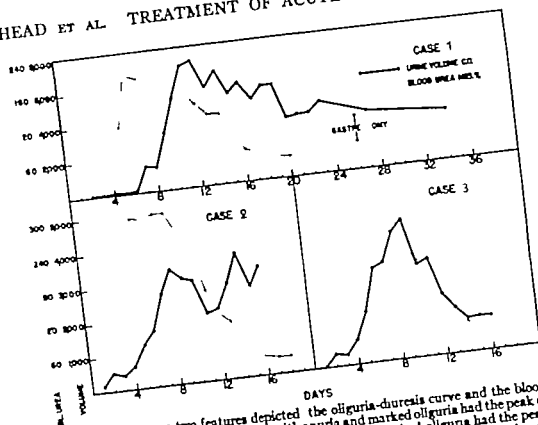


Fig 1 There are two features depicted the oliguria-diuresis curve and the blood urea concentration (azotemia) Case 1 with anuria and marked oliguria had the peak of the diuresis on the twelfth day Cases 2 and 3 with less marked oliguria had the peak on the eighth and ninth days, respectively The sharp recession in azotemia began with the peak of the diuresis.

a fluid overload Thus 2 patients treated by pentoneal irrigation and displaying definite edema had a blood pressure of 160/110 and 170/90 millimeters of mercury (28) In the former case diuresis was followed by a blood pressure recession to 120/85 millimeters of mercury

**Phase 3** The third phase is that of diuresis and constitutes the early period of recovery The diuresis tends to be copious and may be associated with prominent excretion of salt from the body i.e salt losing diuresis The extent of the diuresis and salt loss seem to be related to the severity of the oliguria of the second phase (compare Case 1 with Cases 2 and 3) The daily salt loss may amount to 20 to 40 grams

After the copious diuresis there is usually a period of prolonged renal convalescence during which polyuria persists The renal clearance may remain depressed for a varying period In a few instances where this feature has been studied by us the renal function returned to near normal within 2 to 4 months

Additional features The urinary volume computed against time in days describes a

characteristic curve that may be designated as the oliguria-diuresis curve In any isolated example the daily plotting of this curve can be used to designate the progress and to yield significant information concerning the prognosis (Fig 1) Thus in cases responding satisfactorily one expects to observe a daily increment in the urine volume and definite diuresis between the eighth and twelfth days The absence of such a trend not only seems to indicate a poor prognosis but may indicate additional complications (27) In our experience attempts to modify this curve by measures which normally stimulate the kidneys to produce urine have failed (27) The characteristics of this curve, apparently based on the functional recovery of the kidneys, correlate well with what is known about the morphologic changes in the kidneys that is alterations that early depict damage and later regeneration and recovery

The ability of the kidneys to regain their concentrating power early seems to be a good prognostic sign In the more advanced cases only rarely does the specific gravity regain a normal or near normal level during the early



TABLE L—LABORATORY STUDIES, CASE 1

Day	Blood urea mgm %	CO <sub>2</sub> CP Vol %	Blood Cl mgm %	Serum N mEq/L	Serum K mEq/L	Fixed Intake c.	Urine vol	Urine urea mgm %	Urine Cl (Na Cl) mgm %	Urine Na mgm %	Urine K mgm %	RBC Mil	Hgb gm %
	97.5		30			830	90					1	7.7
1	12	64				7840	75						
6	5	52	440		6	8490	50	53	360			46	8
	100	53	420	13	6.5	1660	30	130	120			64	8.5
8	100		30	13	6	1600	400	152	80				
	90		440			780	1300	180	360				
						4330	1300	178	300	40	7.5		
	70		420	30	5.9	6900	730		180	200	7.3		
	14	50	480			7800	30	44	40	30	3.4		
	20	56	30	15.4	6	7430	5700	333	960	165	20		
	20		300			6300	6600	53	300	90	5		
5						4900	1300			1	27	17	8
6	54	66	330			5400	5800			20	15	7.8	
						5900	700	364	40	70	5.1		
12	40				5.6	7600	1300	30	360	167.5	7		
				40		600	300		130	166	37	3.8	17
20	36	54	540			3000	530	5	20	60	43.5		
						4300	3600		50	95	36		
	33		20	14		4400	3600	3.7	220	5	30	4.4	14
						4700	4700						
27						3000	400						
34	30			16		4300	3000		50	50			

phase of recovery. The specific gravity therefore may fail to indicate the true progress. The ability of the kidneys to concentrate urea, on the other hand seems to be a good prognostic sign (Fig 2). Thus in properly recovering patients it has been observed (27) that the urine urea concentration may change from 10 to 20 per cent of normal during oliguria to 40 to 75 per cent of normal during the diuresis. The concentration of salts in the urine does not appear to be as applicable as a prognostic sign.

#### RENAL LESIONS

Grossly the kidneys when observed at autopsy are found to be of increased weight not infrequently by a factor of two. Much of the increase in weight seems to be due to a greater water content (12). On section the cut surface bulges and the margins retract, thereby indicating an increased subcapsular tension. The cortex is pale gray and rather friable. The medulla is well striated and purplish in color.

The pyramids are thus made prominent. Microscopically the findings vary in accordance with the time interval since the initial injury. The greatest brunt of the injury is sustained by the distal segment of the nephron. Early (first few days) one may observe degenerative changes and focal necrosis in this segment. The areas of necrosis initiate focal inflammation. There may be tubulovenous connections (15) and partial thrombosis of thin walled veins. Heme cast in this area vary in number and are particularly prominent in hemolytic cases. The glomeruli appear intact morphologically but protein material in the capsular spaces indicates glomerular membrane damage. The proximal segment is the least affected but may demonstrate degenerative changes. Interstitial edema may be prominent. Medullary peritubular venocapillary hyperemia is outstanding. Between the eighth and tenth days regeneration is well advanced (27). The newly regenerated cells are flat but

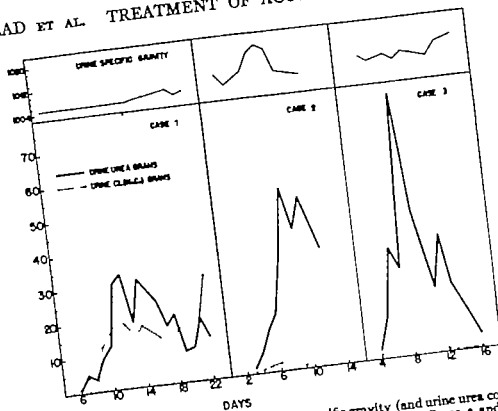


Fig. 3. Case 1 with a persistent low urine specific gravity (and urine urea concentration) had a prominent salt output during the diuresis. Cases 2 and 3 with normal or near normal urine specific gravity (and urea concentration) had a low salt output during the diuresis. The urine urea output was not as prominent in Case 1 (lower concentration, starvation) as in the 2 other cases (normal concentration, lack of starvation).

soon gain more and more substance. Experimentally (30) by the twenty first day the regenerated epithelium appears near normal. Focal granulomatous lesions and scars may develop. During this recovery phase quaternary epithelial cells and casts apparently gradually creep into the renal pelvis and pass out in the urine.

The morphologic studies demonstrate three important points. First, early there may be not only degeneration but outright necrosis of tubular cells. Second regeneration is well established between the eighth and tenth days. Third a near normal appearance is regained by many tubules by the twenty first day. These pathogenetic changes correlate well with the clinical course. Both clinical and morphologic aspects are taken to possess strong therapeutic implications.

#### CASE REPORTS

Three additional closely observed cases belonging in this category are being reported. Each patient exhibited distinct signs of renal insufficiency and in accordance with conven-

tional appraisal can be considered to have had a poor prognosis. In each instance there occurred a very satisfactory recovery and each patient was discharged from the hospital in an ambulatory state. It is believed that the satisfactory outcome was implicitly related to the therapeutic management of these patients. In the Discussion the question of "severity" of these cases will be further elaborated. The type of cases are as follows: (1) severe hemorrhages followed by an incompatible (hemolytic) blood transfusion; (2) extensive operation followed by an incompatible (hemolytic) blood transfusion; and (3) an extensive chest operation with multiple periods of hypotension.

**CASE 1** (Dr A. W. Terrell.) A white male 47 years old gave a long history of epigastric distress (10 to 15 years) with intermittent episodes of voluminous vomiting. These episodes usually yielded to medical treatment and rest. Repeated x-ray examinations were said to have demonstrated a large dilated stomach but no definite organic lesion. During the preceding 3 years he had had intermittent heme-mesis and black tarry stools.

The present episode began 2 weeks ago and consisted of epigastric discomfort, occasional vomiting and evidence of continual bleeding. Four days ago

the patient was admitted to another hospital and was given two blood transfusions. The first transfusion was uneventful. The second transfusion, 3 days ago was discontinued after about 100 cubic centimeters had been given because of a severe reaction. The onset was sudden with chill headache generalized tingling sensations vomiting and fever. The rate of the blood pressure at the time of the reaction not known. There was no urinary output for 48 hours. On the third day the urine passed (exact amount not known) was dark brown in color. The next urine passed was on the fourth day (90 c.c.). During the first three days, and prior to admission to the present hospital the intake consisted of small amounts of milk water and soup by mouth most of which was said to have been vomited. During the first 12 hours after admission the patient was given 5,000 cubic centimeters of 5 per cent dextrose in distilled water. The subsequent findings are depicted in Table I.

This patient was placed on a regimen which has been described (17). Despite a prominent anemia, it was decided not to give additional transfusions as previously emphasized until later because of a marked anxiety by the patient toward transfusions. The blood pressure was normal and other circulatory features appeared well compensated. Essentially the regimen in this case amounted to (a) an attempt to limit the daily fluid intake to that immediately lost, (b) the prevention of sustained acidosis and, (c) allowing the kidneys to recuperate without any attempt to stimulate them into urine production prematurely.

The attempt to replenish the daily loss was not completely successful as can be determined from Table I. During the 13 days between the fourth and sixteenth days the average daily fluid intake over and above the urinary output (for insensible loss) was 350 cubic centimeters. The latter figure includes the fact that between the ninth and eleventh days there was a definite deficit. It is considered that this volume is short of the actual insensible loss by at least about 50 per cent thus accounting for the minimal signs of extracellular dehydration exhibited by the patient. Despite this deficit the course of the patient was very satisfactory.

The advanced pyloric stenosis prevented the proper oral administration of fluids and nourishment. Between the sixth and seventeenth day an average of 870 cubic centimeters of milk and cream formula were taken orally daily and thereafter about 1000 cubic centimeters of the same formula were taken daily. During the same period the patient averaged a daily intake of 3.6 grams of sodium bicarbonate by mouth although which was retained. There was an adequate daily intake of vitamin C and B complex.

On this regimen and despite a moderate water deficit the patient had marked diuresis by the twelfth day. Severe oliguria had existed for 6 days. Concomitantly with the diuresis the azotemia abated promptly (Fig. 1). Throughout the entire course the patient was mentally clear and at the height of the

oliguria and azotemia he was able to read periodicals at intervals throughout the day.

In Table I it can be noted that at no time was there severe acidosis. The serum sodium concentration was low early and was elevated to normal levels after the peak of the diuresis was attained. Between the sixth and the ninth days the patient received 23 grams of sodium bicarbonate by mouth and despite having an extracellular water deficit the serum sodium concentration was not elevated to the lower limits of normal at this time. The serum potassium concentration was slightly elevated early. This was perhaps related to the hemolysis. The potassium concentration gradually receded to the normal range. After the fifth day and while renal insufficiency was still prominent the patient received about 1 gram of potassium daily in the milk used in the ulcer regimen. As in the case of sodium, despite this intake of this cation, there was a gradual recession in its concentration as previously noted (17). The blood chloride concentration revealed a pattern similar to that of the serum sodium concentration.

The urine specific gravity (Fig. 2) in this case remained depressed throughout the hospital stay (1.005-1.008). Until the thirty-fourth day the urine urea concentration was likewise depressed (14 to 16 per cent of normal). There was a gradual increase in the daily urinary output of urea and chlorides (as NaCl) until substantial quantities were excreted during the diuresis mainly as a result of the copiousness of the diuresis. The excretion of sodium and potassium was likewise prominent during this period.

The anemia was marked early. Subsequently as a result of 1300 cubic centimeter transfusions and bone marrow regeneration, the anemia was eradicated.

On the twenty-sixth day because the patient continued to display evidence of severe pyloric obstruction a gastrectomy was performed (Dr. J. V. Goode). The operation lasted 4 hours. Convalescence was rapid and satisfactory and the patient was discharged from the hospital ambulatory 35 days following the reaction. Ten months later the patient was continuing to do well.

In this case there was a severe blood loss anemia and acute renal insufficiency following an incompatible (hemolytic) blood transfusion. The case is appraised as a severe one for the following reasons: (1) marked oliguria for 6 days (2) persistently low specific gravity of urine and low urine urea concentration (3) marked azotemia and (4) peak of diuresis on the twelfth day. The patient recovered very satisfactorily on a regimen which maintained a fair level of hydration but did not attempt to force diuresis. Time was allowed for renal recovery and regeneration. The tendency toward acidosis was curbed with sodium bicarbonate. The diuresis occurred despite a

TABLE II.—LABORATORY STUDIES, CASE 2

Day	Blood urea mgm %	CO <sub>2</sub> CP Vol. %	Plasma Cl mEq/L	Serum N mEq/L	Serum K mEq/L	Fluid intake c.c.	Urine vol. c.	Urine urea mgm %	Urine Cl (Na Cl) mgm %	Urine N mgm %	Urine A mgm %	Hgb. gm. %	Icterus index
						4800	133						15
						1000	333						14
	77.7	65	13.5										
	90	8.0	9.1					418	80				
					6.0	350	400		00			9	
3	113	77.3	00	30	4.7	50	640	850	00				
4	88	64.5	05.4	13.8		2300	50	944	10	99	3		
5	90.5	50.8	06.0			1700	65	003	10	14.5	00		
6	70	65.3	08.6			1400	9600	8	00	77.5	06		
7	300	59.3		130		6000	1300	353	50	60	04		
8	300	47.6				5900	3050	1374		32.5	86	8.7	
9	170	57.8	09.0	13	4.8	1800	9000	170	3	54	04		
	84	58.7	00	46	4.4	1800	1900		25				
	6	65.	3.5			400	3000	1684					
	8	70.8	05			1880	170						
3	103	6.5	103			44	1550						
4						1660	550						
5	36	8.8	90			1830	300						
6						1400	1500						
7	30	83.7	0.4			4640	4050						
8	30	80	01.4			4650	4750						
9	26	81.7	9	130	4								
10													
	19	8	01.7										

moderate water deficit. During the diuresis attempts were made to replace the fluid loss in the urine and the insensible loss. As much as 20.5 grams of salt were lost daily in the urine at this time.

It is believed that this case is the first one reported as having undergone very successfully a major operation soon after recovery from severe acute renal insufficiency. That this procedure was justified is attested by the rapid postoperative recovery.

CASE 2 (Dr. W. F. Mengert.) This patient, a 43 year old colored female with a carcinoma of the body of the uterus was seen in another hospital. Two days prior to hysterectomy 500 cubic centimeters of blood was given without any reaction. The operation lasted 5 hours and immediately afterward 500 cubic centimeters of blood were given. Just as the transfusion was terminated the patient developed a severe chill and the temperature rose to 103 degrees F. Later 100 cubic centimeters of cloudy dark brown urine were obtained by catheter. On recheck it was learned that the patient was of type O and the infused blood was of type A.

Prominent oliguria, azotemia, urinary casts, hypertension and hyperbilirubinemia developed (see Table

II). A decrease in serum sodium and blood chloride concentration also occurred.

On the first day the patient received fluid in excess of the immediate needs but this abnormality was corrected by decreasing the intake on the second day. Thereafter the fluid intake was made to equal the estimated insensible loss through visible sweating and the urinary output. The renal insufficiency phase developed while the environmental temperature fluctuated between 90 and 103 degrees F and consequently the intake was increased accordingly. The fluid intake included 1500 to 2000 cubic centimeters of a liquid formula<sup>1</sup> of low salt content and approximately 1 calorie per cubic centimeter. During the renal insufficiency phase 24 grams of sodium bicarbonate in 6 doses were given and acidosis was not a problem in this case. One 500 cubic centimeter blood transfusion (no reaction) and daily supplements of vitamin B complex and vitamin C constituted the only additional measures.

The urinary output began to rise sharply on the fourth day (Fig. 1) and the peak of diuresis occurred on the eighth day. Beginning on the eighth day there was a precipitous recession of the azotemia. The patient was placed on a soft diet by the seventh day and on a general diet by the ninth day.

In this case there was no anuria and the oliguria was not as prominent as in Case 1. There were three

<sup>1</sup>There are several such preparations available on the market.

TABLE III.—LABORATORY STUDIES, CASE 3

Day	Blood urea mgm %	CO <sub>2</sub> CP Vol %	Blood Cl mgm %	Serum N mEq/L	Serum K mEq/L	Fluid intake c.	Urine vol c.	Urine urea mgm %	Urine Cl (Na Cl) mgm %	RBC med.	Hgb. gm. %
							6(7)			3 01	13.4
	3					2700	233			3 63	14.75
3	30	60	430		30	390					
	70	30	400		33	600	500	00		3	13
5	270	34	400		305	30	770	40			
6						163	34	3	60		
7	30		400	24	3.8	37	1925	980	60		
8	300	60	30	43	3	3470	1530	2700	40		
	303		440			3340	3000	060	40		
	70	33	430			3 30	3433		40		
	00	7	30			3745	770	703	80		
						3500		94	40		
						3130	390	331	30		
		64	430			3400	1000				
		6	440			370	1000	930	30		
16				4	4	040	130	444	60		

indications of an early return of the concentrating power of the kidneys. First the urine urea concentration was about 50 to 60 per cent of normal by the fifth day and was 80 to 100 per cent of normal by the eighth day. Consequently during the diuresis large bulks of urea were excreted via the urine (Fig. 3). Second the urine specific gravity was at normal level between the sixth and the ninth day. Third there was a low salt output during the diuresis. On the twelfth day the urea clearance was 70 per cent of normal. The arterial blood pressure was 160/70 on the fourth and sixth days. Between the eleventh and fourteenth days it ranged near 150/90. It then dropped to 130/80 and 120/70 between the eighteenth and twenty-first days. This patient recovered satisfactorily and was progressing nicely 4 months later.

This patient received 500 cubic centimeters of incompatible blood and had an evident severe reaction after all of the blood had been taken. Renal insufficiency with hypertension developed. The hypertension persisted for over 2 weeks. The patient was maintained at near normal hydration and diuresis with recovery occurred in the expected time.

By criteria mentioned by other workers one would have to consider this case as a very severe one. We do not find ourselves in agreement with this view however. It is believed that the early recovery of adequate renal function (early diuresis, concentration power and salt conservation) indicates a less extensive

type of damage. One wonders if the absence of prolonged hypotension in association with the reaction was not a factor in early recovery.

**CASE 3** (Dr. D. P. Paulson.) A white male aged 61 years had a resection of the esophagus for carcinoma of the middle third. The stomach was brought up through the diaphragm and a high anastomosis was made with the esophagus. The operation lasted 7½ hours. Anesthesia consisted of ether, nitrous oxide, cyclopropane and oxygen. During the operation 3000 cubic centimeters of blood, 150 cubic centimeters of 3x concentrated plasma and 1000 cubic centimeters of 5 per cent glucose were given. On 4 occasions during the operation the blood pressure was significantly lowered and the pulse pressure was narrowed (70/30 to 90/75). The sum of these periods of hypotension amounted to 80 minutes during the operation. Immediately after the operation was completed the blood pressure was 110/70 millimeters mercury but within 3 hours it became 96/65. After 500 cubic centimeters of blood and 1000 cubic centimeters of glucose solution the blood pressure became normal. On the second day the patient was found to show signs of dehydration with hemoconcentration and mental cloudiness. After 2000 cubic centimeters of glucose solution there was apparent improvement.

It soon became evident that renal insufficiency was prominent (see Table III). Oliguria, azotemia, lowered blood chloride, serum sodium and plasma bicarbonate concentrations developed. The blood pressure became 140/80 millimeters mercury.

The management of this case was very similar to that of Case 2. The blood loss during the operation

TABLE IV—URINALYSES CASES 1, 2, 3

Case	Day	Sp. gr.	Reaction	Albumen mgm. %	Sugar	Acetone	RBC	WBC	Cells
1	4	1.005	Acid	800	—	—	+++	++	++++
	11	1.005	Neut.	—	—	—	—	+	—
	13	.008	Neut.	Tr	—	—	++	+	++
	20	.008	Acid	++	—	—	+	++	++++
		1.0	Acid	+++	—	—	—	—	—
2	6	1.017	Alk.	—	—	—	—	+	++
		.008	Alk.	—	—	—	—	—	—
			Acid	00	—	—	—	—	—
			Neut.	40	—	—	—	—	—
	7	.5	Alk.	—	—	—	—	—	—

was replaced to such an extent (3500 c.c.) that only a slight anemia developed subsequently. During the period of oliguria attempts were made to maintain a fluid intake equal to the estimated insensible water loss plus an amount equal to the urine volume. This attempt was not completely successful. Between the second and eleventh days the patient received an average of 851 cubic centimeters of water per day over and above the volume replacing the urinary volume. At the same time a soft diet and a proprietary high caloric low salt diet were given. Since the environmental temperature was high (summer season) it was obvious that the insensible loss was not completely replaced and that a moderate water deficit developed. This water deficit was of an insufficient proportion to deter the phase of diuretics which occurred in a very similar manner to that of Case 2.

Between the fourth and eighth days 20 grams of sodium bicarbonate were given orally to check the acidotic tendency. Daily vitamin supplements (B complex and C) were administered.

The peak of the diuresis occurred on the ninth day and following this there was a marked recession of the azotemia (Fig. 1). The urine urea concentration and urine specific gravity returned to near normal levels early. As in Case 2 there was a marked urine salt output during diuresis, associated with a low urea excretion (Fig. 2). Thus during and following diuresis it became necessary to replace water mainly as the salt loss was not great. Recovery from the renal insufficiency occurred. One month later the patient was continuing to do well from the renal standpoint.

The clinical manifestations and course of this case were very similar to those of Case 2. The acute renal insufficiency however, seemed to result mostly from a prolonged operation with an additive prolonged interval of hypotension. In this case as in Case 2 there was an early return of the concentrating power of the kidney and in association with this feature during the diuresis there was a very bulky

urea excretion with a low salt output (Fig. 2). The peak of the diuresis also occurred earlier than in Case 1. It was again demonstrated that the diuresis can develop despite a moderate water deficit.

#### DISCUSSION

The state of acute renal insufficiency which has been designated as the anoxic kidney "lower nephron nephrosis" and "hemoglobin uric nephrosis" has been attended by a high mortality rate. Commonly encountered complications have been generalized edema, mental aberrations and acidosis. These complications most often have been related to attempts to increase the urinary output during the oliguric period by an excessive intake of water or water and salts. The expected high mortality rate in this group of cases has been markedly lowered by altering the therapeutic approach. Under this proposed management even very severe cases have responded satisfactorily.

The modified management consists of positive measures and has as its basis a combination of morphologic and clinical features. Morphologically it is well established that tubular degeneration with or without focal necrosis of the distal segments is evident early. Tubular recovery and regeneration are definite between the eighth and twelfth days. By the twenty first day morphologic recovery is well advanced. Clinically the cases can be divided into three phases and the management is additionally based on changes occurring during these phases.

The hypotension of the first phase is most often related to oliguria of blood loss type



maintained, it appears that one can afford to wait and allow renal excretion to be the guide in the daily appraisal of the progress of the case. The prevention of severe acidosis may be attained by administering moderate doses of sodium bicarbonate. With the latter the serum sodium concentration is not necessarily rapidly elevated even when a slight extra cellular water deficit exists. As emphasized by Macgrath (16) an excess of sodium bicarbonate is to be avoided. It is also of interest that a daily intake of 0.5 to 1 gram of potassium during the renal insufficiency phase in our experience has not been followed by hyperkalemia even when a slight water deficit existed. These findings concerning the serum potassium concentration are not unusual and conform with certain observations made by Keith and others.

Failure to replace water and salts adequately during the diuresis may be associated with complications. Dehydration shock like state, mental aberrations, convulsions may result.

Each phase in the course of this condition seems to be attended by its own therapeutic implications and its own potential complications. Thus deficits and overloads of various fluid compartments may develop under various therapeutic approaches. The mechanisms involved in alterations of various fluid compartments have been well elaborated by Moyer.

As a result of complications related to management relatively milder forms of this condition may be made severe in appearance or even fatal. Thus, attempts to force water or water and salts early in Cases 2 and 3 could have resulted in disastrous sequelae but with the outlined management these cases responded rapidly and satisfactorily.

#### SUMMARY

The high mortality rate of certain types of acute renal insufficiency may be substantially lowered by altering the therapeutic approach. Three closely observed cases have been presented to lend additional support to this thesis.

The proposed management consists of positive measures based on renal morphologic changes and the main features of the clinical course. There are three main phases, each of

which requires its own therapeutic measures. The hypotension of the first phase is best managed with completely compatible blood. During the second phase (renal insufficiency) a near normal state of hydration is maintained and complete starvation and definite acidosis are prevented as much as possible. During the third phase (diuresis) not only is the water loss replaced but as much as possible a gram for gram salt replacement is made.

The regimen is based on the premise that damaged kidneys require time for healing. Evidences of healing structural and functional appear between the eighth and twelfth days. Survival of properly managed cases through this interval is apparently greatly influenced by the daily betterment of renal function.

Attempts to stimulate the kidneys to produce urine during the oliguric period usually fail. An excessive intake of water or salts over that immediately lost causes an overload of various fluid compartments and upsets existing osmolar concentrations. It is believed that much of the mental aberrations observed early can be attributed to these complications.

The condition is associated with varying grades of severity. Criteria which have been helpful in ascertaining the relative severity have been discussed. That relatively milder cases may be made fatal if not properly managed seems evident.

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# THE INTRAMURAL EXTENSION OF CARCINOMA OF THE DESCENDING COLON, SIGMOID, AND RECTOSIGMOID

## A Pathologic Study

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THE present-day approach to the cure of carcinoma of the colon is surgical extirpation of the primary lesion and all its extensions with restoration of continuity of the bowel and preservation of sphincteric control whenever feasible.

The importance of carcinoma of the colon is attested by its incidence and cause of death in the general population. The mortality statistics of the Bureau of Census for 1936 give the total death rate from all causes as 1:151.8 per 100,000 population (22). Of these deaths per 100,000 cancer and other malignant tumors cause 111 per 100,000. Of the deaths due to cancer, cancer of the intestines except the duodenum, rectum and anus accounted for 12 per 100,000 population. Since less than 3 per cent of carcinomas of the intestines originate in the small bowel, the figure for cancer of the intestines represents essentially that for carcinoma of the colon exclusive of the rectum and anus.

Goforth stated that approximately 10 per cent of all carcinomas in the human body and about 96 per cent of all intestinal carcinomas occur in the large intestine and rectum. Azeman, Maydl, Muehler and Nothnagel, in a series of almost 70,000 necropsies, found that 5,796 deaths had been due to carcinoma in general. Almost one-fourth were in the intestinal tract. Rankin, Bargen and Buie quoted Judd's figures on the location of the cancer in the large bowel: There were 159 (25 per cent) in the cecum and ascending colon, 29 (4 per cent) at the hepatic flexure, 75 (10 per cent) in the transverse colon, 24 (3 per cent) at the splenic flexure, 46 (6 per cent) in the descending colon, and 292 (46 per cent) in the sigmoid

Karsner and Clark, in an analysis of 104 cases of carcinoma of the large intestine, found 28 per cent of the lesions in the right portion of the colon, 10.7 per cent in the transverse colon, 16.7 per cent in the descending colon, and 44.4 per cent in the sigmoid. Lockhart Mummery listed the locations of 560 carcinomas of the colon which were essentially the same as those given by Judd: appendix, 0.7 per cent; hepatic and ascending colon, 22.5 per cent; hepatic flexure, transverse colon, and splenic flexure together, 21.6 per cent; descending colon, 5.3 per cent; and sigmoid, 49.8 per cent (19). It can be seen that nearly 50 per cent of carcinomas of the colon occur on the left side. These figures do not include the rectum, which ranks second to the stomach in incidence of carcinoma in the entire gastrointestinal tract.

The purpose of this work was to determine by a pathologic study the extension of any given carcinoma in the long axis of the bowel wall. The study is limited to lesions occurring in the descending colon, including the splenic flexure, sigmoid and rectosigmoid.

Surgeons dealing with carcinoma of the large intestine have always removed a considerable portion of apparently normal bowel on either side of the carcinoma in order to be sure to include all the extensions of the tumor in the bowel wall. In certain situations especially in the rectosigmoid, it is technically difficult to accomplish wide excision of apparently normal bowel below the lesion and still restore the normal continuity of the bowel. If the surgeon could resect the bowel closer to the primary lesions without leaving malignant tissue behind, operations in which continuity of the bowel is restored, such as anterior resection, would be feasible in a larger number of cases. With this in mind, this study was undertaken to determine the microscopic extension of the carcinoma in the long axis of the bowel.

Abridgment of thesis submitted by Dr. Black to the Faculty of the Graduate School of the University of Minnesota in partial fulfillment of the requirements for the degree of Master of Science in Surgery.  
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Little attention has been paid to the intramural extension of carcinoma of the bowel in its long axis since 1914. Clogg in 1904 studied 25 cases and reported no intramural spread. Cole in 1913 studied 20 cases in which he took longitudinal strips of bowel including the tumor and examined sections microscopically. There was doubtful extension of one colloid carcinoma 1.4 inches (3.5 cm) from the lesion however in spite of this he concluded that the typical intramural spread was wedge shaped with the apex the lesion itself and the base, the serosa. The extension was slight but equal above and below the lesion. Cheatile, in 1914 in a similar study of his own cases reported no longitudinal spread of carcinoma. Monsarrat and Williams, in a study of rectal carcinoma found evidence of longitudinal spread 2.5 inches (5.7 cm) from the lesion in 1 case but for the most part the distance of spread was less than 1 inch (2.5 cm). He also noted that infiltration was widest in the plane of the longitudinal muscle coat. Miles (16) noted that spread of cancer in the submucosa extended no more than a few lines from the mucosal growth and that the spread in the deeper layers was just as limited. Lockhart Mummery observed that spread of carcinoma by infiltration through the rectal wall was characteristically greater in the submucosa than in the mucosa and this is borne out by our study. Dukes (9) stated that the opinion as to spread by direct continuity based on gross examination will not be altered much by the microscopic examination.

Several classifications based on the intramural and extramural spread of carcinoma of the rectum have been devised. The best known is that of Dukes (9). He classified the carcinomas into three groups. In group A he placed those growths which are limited to the wall of the rectum. In group B those which have extended into the extrarectal tissues but have not metastasized to the regional lymph nodes and in group C those which have metastasized to the regional lymph nodes (13). Simpson and Mayo classified carcinoma of the rectum according to the depth of penetration through the bowel wall. Group A included those lesions which are limited to the mucosa. Group B those lesions which penetrate to the

submucosa and group C, those lesions which penetrate to the serosa. Such classifications are useful in determining the prognosis. In cases of lesions in group A the prognosis is best and in group C, the worst.

#### METHODS OF SPREAD OF CARCINOMA

Although the original work in this paper deals only with the spread of carcinoma in the bowel wall, a brief review of all methods of spread is indicated.

Carcinoma of the colon spreads in 3 ways (1) by local extension from its origin (2) by invasion of the venous system and (3) by means of the lymphatics.

**Local extension.** Most carcinomas of the colon are slow growing. They take their origin from altered mucosal cells deep in the crypts of Lieberkuehn. Welch thought that mucosal spread is by contact and that some stimulus from the cancer cell be it chemical, virus, or other acts on the cells adjacent. The spread through the layers of the bowel wall is by infiltration. The muscle is penetrated by rootlike projections between the bundles of muscles. Lockhart Mummery and Dukes (8) stated that ulceration usually begins when the muscular layer is reached due to interference with the blood supply at the surface and local sepsis.

**Venous spread.** Invasion of the venous channels may occur at any stage in the development of the carcinoma. When this occurs the formation of malignant thrombi and dispersion of malignant emboli make complete removal of the carcinoma impossible. The lesion most commonly spreads through the portal system to the liver. The work of Batson on the function of the vertebral veins with their anastomoses with the portal system explains the occasional occurrence of metastatic lesions in bone especially the sacrum coccyx, and lumbar vertebrae. Studies by Collier, Kay and MacIntyre, Seefeld and Bagen, and Dukes and Bussey have shown that intravascular invasion occurs in 15 to 20 per cent of malignant lesions of the colon. Seefeld and Bagen showed that the incidence of venous invasion increased as the grade of malignancy (Broders' method) and the extent of mural penetration increased. Visceral metastasis is not always present when



Fig. 1 Intramural lymphatic system of the colon. Graphic presentation of Cole's description.

evidence of venous involvement is found. Dukes and Bussey were unable to find other metastatic involvement at necropsy in 10 of 13 cases in which the veins were invaded.

**Lymphatic system.** The importance of spread of carcinoma in all parts of the body through the lymphatic system has long been recognized. All operations employed for extirpation of malignant growths in the colon are designed to include removal of the lymphatics that drain the region of involvement. The lymphatic system of the colon can be divided into the extramural (serosa to regional lymph nodes) and intramural (mucosa to serosa) components.

The anatomy of the extramural lymphatics was best described by Delamere, Poirier and Cunéo. The lymphatics of the ilio pelvic portion of the colon at first traverse some small glands which are attached to the terminal branches given off by the paraintestinal arch and formed by the anastomosis of the three sigmoid arteries. They then terminate in glands placed over the inferior mesenteric artery. The lymphatic vessels of the descending colon present an arrangement similar to that of those in the ilio pelvic portion of the colon. In other words, the extramural lymphatics of the left portion of the colon are situated along the arteries to that region. Recent work by Glover and Waugh has shown that the spread of carcinoma of the rectum and rectosigmoid through these lymphatics is upward in 99 per cent of the cases.

The anatomy of the intramural lymphatics was best described by Cole (Fig. 1). The lymphatics of the mucosa do not exist as a continuous plexus but are arranged as decussating branches from the collecting stems which pierce the circular muscular coat. The intermuscular lymphatics are similarly limited

Small branches situated between the muscle coats drain into collecting stems which empty into subserous plexuses. From here the drainage is to the paracolic lymph glands which are a part of the extramural lymphatic system.

#### STUDY OF 103 SPECIMENS

**Materials and method.** The materials used in this study were 103 specimens of bowel removed at operation at the Mayo Clinic. A few criteria were used in their selection: the lesion had to be in the descending colon including

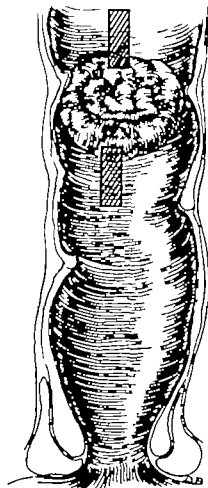


Fig. 2 Position of blocks removed from specimens.

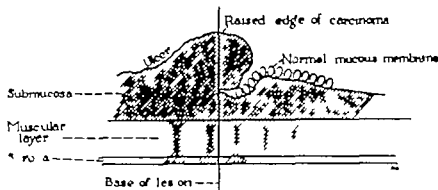


Fig. 3. The edge or base point of the lesion.

the splenic flexure, the sigmoid or rectosigmoid and at least 1 inch (2.5 cm.) of grossly normal bowel had to be present above and below the carcinoma. Specimens were selected so that lesions of all four grades of malignancy (Broders' method) were included in the study.

Each specimen was subjected to the following examination: blocks of tissue through the entire bowel wall were removed above and below the lesion in such a manner that the edge of the tumor was included with the normal bowel (Fig. 2); frozen and paraffin sections of blocks were made; all sections were stained in the usual manner with hematoxylin and eosin and subjected to careful microscopic examination.

The examination of the slides was carried out in the following manner: the edge or base point of the lesion was marked on the slides; the limit of extension of the carcinoma was marked on the slide and the distance from the base point was measured in millimeters; the greatest depth of penetration through the bowel wall was noted; the layer of the bowel wall in which the farthest extension had occurred was noted; and finally the malignancy of

the tumors was graded according to the method of Broders.

The edge or base point of the lesion is illustrated in Figure 3. It was felt that the cauliflower or overlying free edge of the tumor was movable and therefore inconstant on palpation so that it should not be used for measurement. Consequently, the base of this free edge was chosen as the base point of the lesion.

The carcinoma was followed out to the point of greatest extension from the lesion (Fig. 4). This point was marked on the slide and the distance between the two points was measured in millimeters. The layer in which maximal extension had occurred was noted as well as the layer of deepest penetration through the bowel wall.

All tumors were graded independently by the author and then checked with the grade reported by the pathologist at the time of removal. This grading corresponded well with the reported grades, and in those instances in which a difference occurred these specimens were checked by Dr. John R. McDonald of the section on surgical pathology of the clinic. Table I shows the grades of the carcinomas.

TABLE I.—THE MICROSCOPIC GRADE (BRODERS) OF MALIGNANCY OF LESIONS AND THEIR LOCATION IN THE COLON

Grade	Rectosigmoid	Sigmoid	Descending colon	Total
1	5		5	10
2		14		14
3		7	9	16
4		1	7	8

TABLE II.—INVOLVEMENT OF LYMPH NODES IN EACH LOCATION

Location	Specimens	Involvement of lymph nodes	
		Cases	Per cent
Descending colon	10		40
Sigmoid	20	10	50
Rectosigmoid	7	10	100
Total	37	20	54

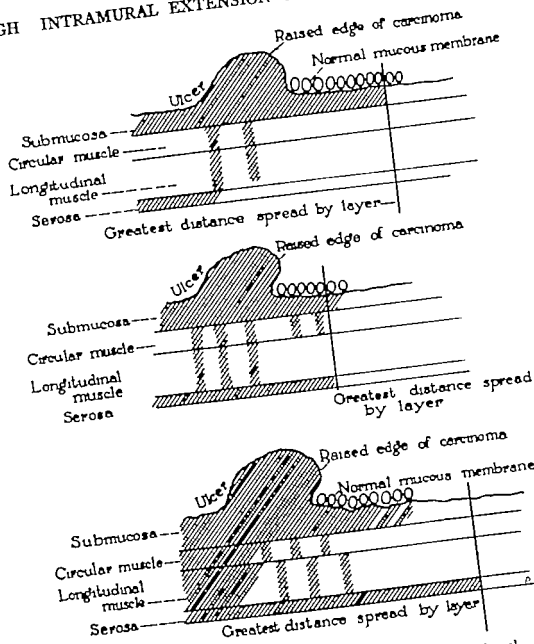


Fig 4. Manner of extension of carcinoma in wall of the large bowel.

studied and the location of the lesion in the bowel

Information was available regarding the presence or absence of involvement of lymph nodes from the pathologic reports on the fresh specimens. This information was accepted without further study of the specimen. Table II shows the percentage of cases in which lymph nodes were involved for each location. These figures are probably low since all the nodes in each specimen removed were not examined microscopically. This information is presented only to show that the short distance of intramural spread which was found cannot be explained on the basis of early lesions or the

low-grade invasive power of the tumors studied.

**Results** The results of this study are best discussed under the following headings: (1) extension by plane of the bowel wall, (2) depth of penetration through the bowel wall, and (3) relation of involvement of lymph nodes to depth of penetration.

Extension by plane of the bowel wall.—The spread of carcinoma in the mucosa ended abruptly and was marked by the raised edge of the lesion. Figure 5 illustrates this phenomenon. In this photomicrograph the normal mucosa can be seen extending up the raised edge of the carcinoma even though a clump of malignant cells lies directly beneath





Fig. 5. Carcinoma, grade 4, showing mucosal and submucosal spread.  $\times 75$ .

Spread in the submucosa was characterized by large masses of carcinoma cells pushing the muscular layers away from the mucosa and increasing the thickness of the bowel wall in the region of the gross lesion. Extension longitudinally under the mucosa was characterized by small islands of carcinoma cells infiltrating the loose submucosal tissues to varying distances and usually surrounded by aggregates of lymphoid cells. The thickness of the bowel wall was not increased. In Figure 5 a small island of carcinoma cells is seen under the villus just to the right of the raised edge of the lesion. The upper diagram in Figure 4 illustrates the submucosal spread under normal mucous membrane. The shaded areas represent carcinomatous infiltration. Note that though the longitudinal spread is greatest in the submucosa the carcinoma has infiltrated to the serosa. Maximal extension occurred in this layer in 50 per cent of all the specimens examined.

The spread through the muscular layer was characterized by incomplete columns of carcinoma cells radiating down between the muscle bundles. This suggests that the spread fol-

TABLE III.—LAYER OF BOWEL WALL IN WHICH GREATEST SPREAD OCCURRED

Layer of bowel wall	Descending colon		Sigmoid		Rectosigmoid	
	Specimens		Specimens		Specimens	
	Number	Percent	Number	Percent	Number	Percent
Submucosa	—	—	5	50	—	50
Circular muscle	3	—	—	—	4	5
Longitudinal muscle	7	—	—	5	—	5
Serosa	—	—	—	5	—	—

lows the paths of the intermuscular lymphatics. Figure 6 illustrates the extension of a grade 1 adenocarcinoma through the muscular layers. Maximal extension occurred in these layers in 26 per cent of all the specimens examined. The middle diagram in Figure 4 illustrates the usual spread of carcinoma through the muscular layers.

In the serosa extension was characterized by small dispersed groups of carcinoma cells situated usually in the subserous layer and surrounded by clumps of lymphoid cells. Figure 7 shows a group of grade 4 carcinoma cells in the subserous layer. The lower diagram in Figure 4 illustrates by the shaded areas the typical spread when the greatest longitudinal extension occurs in the serosal layer. Maximal extension occurred in this layer in 24 per cent of all the specimens.

In Table III are summarized the findings concerning the plane of the bowel wall in which maximal extension occurred for each of the locations in the colon from which specimens were examined. The percentage occurrence in each location is recorded.

No appreciable difference was noted in extension above or below the lesion. The greatest longitudinal extension in any specimen was 12 millimeters and in only 4 of the total number of specimens was the spread 5 millimeters.

TABLE IV.—EXTENSION OF CARCINOMA

Location	Minimal	Maximal	Average
	Millimeters		
Descending colon	less than	—	—
Sigmoid	less than	—	—
Rectosigmoid	less than	5	—



Fig. 6. Carcinoma, grade 1 infiltrating the muscular layers of colon



Fig. 7. Carcinoma grade 4 infiltrating in subserous layer of colon

or more. All of these were located in the descending colon. This would indicate that greater extension occurs in this location in the bowel. In Table IV the minimal, maximal, and average distance of spread of carcinoma for the three locations studied are listed.

The grade of carcinoma had no relation to the intramural spread. Of all the grade 4 carcinomas studied, only one or 7.6 per cent had extended more than 5 millimeters. The lesion which had spread a distance of 12 millimeters was a grade 1 adenocarcinoma.

Depth of penetration.—The depth of penetration through the bowel wall had no relation to the longitudinal spread. The serosa was involved in 37 per cent of all the specimens examined. In all these specimens the greatest longitudinal extension occurred in a layer nearer the mucosa. These findings vary with the contention of Miles (16) that intramural spread is wedge shaped with the apex at the

mucosa. In Table V are summarized the findings concerning the plane of deepest penetration through the bowel wall for each location in the colon and the percentage occurrence for the different locations.

Relation of involvement of lymph nodes to depth of penetration.—Lymph nodes are involved before the carcinoma penetrates through the bowel wall. Of the 48 specimens in which lymph nodes were involved, the depth of penetration through the bowel wall in 24 or 50 per cent, of the specimens was not to the serosa. These findings support the contention of Miles (16, 17) that metastasis to the lymph nodes occurs before the bowel wall is penetrated and are at variance with Dukes' (9) assumption that lymph nodes are not involved until the bowel wall is penetrated.

#### CONCLUSIONS

1. In carcinoma of the colon the raised edge of the lesion may not mark the limit of intramural extension.
2. There is no appreciable difference in intramural spread of carcinoma above or below the lesion.
3. Intramural spread of carcinoma is greater in the descending colon than in other sites in the left portion of the colon.
4. The plane of greatest extension in the bowel wall is the submucosa.
5. The grade of malignancy (Broders method) of the lesion has no relation to the degree of intramural spread.

TABLE V.—LAYER OF DEEPEST PENETRATION OF BOWEL WALL

Layer of bowel wall	Descending colon		Sigmoid		Rectosigmoid	
	Specimens		Specimens		Specimens	
	Number	Per cent	Number	Per cent	Number	Per cent
Submucosa	13	76	3	35.7	3	17.6
Circular muscle	7	4	6	57	6	33.3
Longitudinal muscle	8	16	1	12.5	4	22.2
Serosa		4	14	44		1.1

6 Spread of carcinoma through the bowel wall appears to follow the course of the intramural lymphatics

7 Spread of carcinoma to the extramural lymphatics occurs before the entire bowel wall is penetrated

8 For resection of the left part of the colon for carcinoma only 2 centimeters of normal bowel need be allowed above and below the lesion in order to remove the whole of the primary lesion

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# STUDIES ON VAGOTOMY IN THE TREATMENT OF PEPTIC ULCER

## IV Changes in Gastric Motility and the Effect of Drugs on Motility Following Complete Vagotomy

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THE history of vagotomy and its use in the treatment of peptic ulcer have been recently reviewed (15-18). It is likely that all of the procedures used in man by the early workers in this field resulted in only partial vagus section. Drag

sted's introduction of complete vagotomy as a treatment for peptic ulcer in 1943 (2) has caused renewed interest in the subject.

In June of 1946 a clinical and physiological study of vagotomy in the treatment of peptic ulcer was started on one of the surgical services at the Cook County Hospital (K.A.M.). During the following year vagus section was carried out in 35 cases of peptic ulcer in which definite indications for surgery were present.

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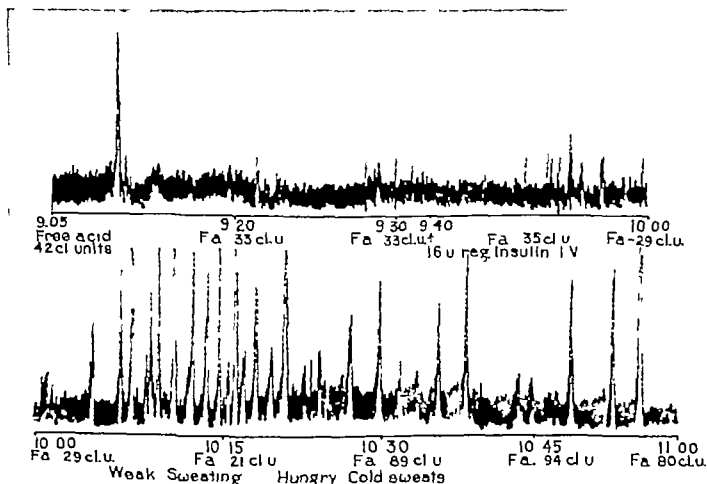


Fig. 1 Gastric motility tracing before vagotomy showing spontaneous and insulin induced hunger contractions.

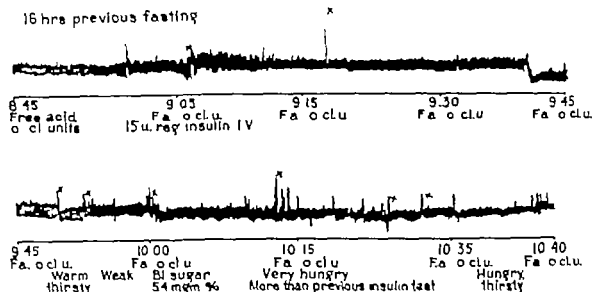


Fig. Gastric motility tracing following complete vagotomy showing no spontaneous or insulin induced hunger contractions.

These patients were thoroughly studied both before and after surgery. A clinical evaluation of this series (9) and results of the physiological studies (19) are published elsewhere. The present report is concerned primarily with the changes in gastric motility and the effects of drugs on gastric motility following complete vagotomy.

Early in our series, 1 of the patients developed an acute gastric retention and dilatation on the 10th postoperative day. This complication aroused our interest in the use of drugs to stimulate gastric emptying after vagotomy.

The therapeutic use of choline esters has been previously studied. The subject has been reviewed by Starr and Ferguson and Goodman and Gilman (5). Youmans demonstrated experimentally the stimulatory effect of urecholine on intestinal motility. Recently Machella, Smith, Grimson and Dragstedt (3) have reported on the use of urecholine in the

treatment of gastric retention following vagotomy. We have previously confirmed this use of urecholine and have reported a similar action of doryl (20). Postlethwait has compared the action of neostigmine, mecholyl, doryl and urecholine on the intestine of the rabbit.

#### METHOD

The motility of the stomach was determined after 16 to 24 hours of fasting by passing a tube into the stomach with a 200 cubic centimeter balloon attached. The balloon was placed high in the fundus of the stomach and its position verified by inflation and gentle withdrawal until a slight tug was felt as the balloon reached the cardiac end of the stomach. The balloon was then partially inflated with 10 to 50 cubic centimeters of air and connected to a water manometer. Recordings were made on a slowly moving kymograph. An average of 10 hours of tracings was made on each of 27 patients.

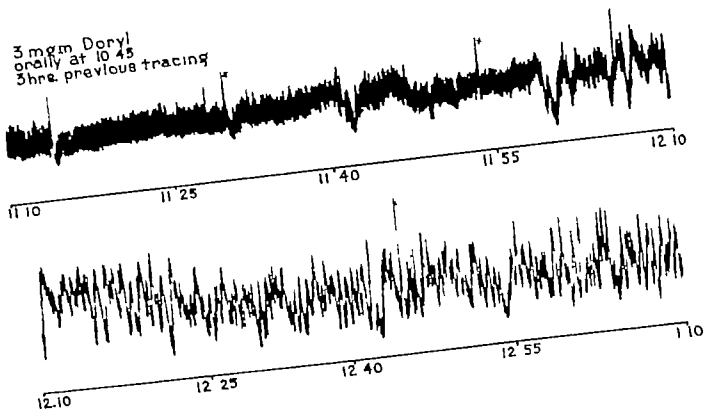


Fig. 3. Postoperative motility tracing showing the effect of 3.0 milligrams of doryl by mouth.

After the spontaneous fasting motility had been determined for 1 to 3 hours, the effect of the following drugs was noted insulin, doryl urecholine prostigmine and mecholyl. In most instances only 1 drug was tested per day in order that a possible synergistic effect would not confuse the results.

#### RESULTS

Before vagotomy all 27 patients showed spontaneous type I and occasionally type II and III hunger contractions (1) (Fig 1). Following complete vagotomy, as determined by the insulin test, 24 patients had no spontaneous hunger contractions in the fundus of the stomach after 16 to 24 hours of fasting. Tonus rhythm was noted but no hunger contractions were present (Fig 2). The patients were studied 10 days to 2 weeks after surgery. Seven of 8 patients studied 3 to 9 months later had no spontaneous hunger contractions. An

insulin test in the eighth case showed return of vagus function after 9 months. Spontaneous hunger contractions were present in the fundus of the stomach.

After incomplete vagotomy as determined by the insulin test, spontaneous type I or type II hunger contractions were noted in 2 of 3 cases.

*Effect of insulin* Before vagotomy insulin hypoglycemia was usually followed by a period of hypermotility (Fig 1). After complete vagotomy in 24 cases there were no hunger contractions in the fundus of the stomach following insulin hypoglycemia (Fig 2). After incomplete vagus section in each of 3 cases insulin hypoglycemia was followed by hunger contractions.

A detailed discussion of the effect of insulin hypoglycemia on the stomach and its use in this study as a test after vagotomy has been reported (18).



Fig. 4. Barium meal 2 weeks after vagotomy had been carried out



Fig. 5. Same as Figure 4, 5 minutes after the administration of 0.5 milligram of doryl subcutaneously

TABLE I.—THE EFFECT OF DRUGS ON GASTRIC MOTILITY AFTER COMPLETE VAGOTOMY

Drug	Dose Milligrams	No. of trials	Results			
			No. effect	Increased motility		
				Slight	Mod. orals	Marked
Carbamylcholine (doryl)	25 subcut					2
	2-4 orally	9				8
	sublingually	(20)				
Urethane of B-methylcholine (urecholine)	5 subcut	3				3
	20 orally	8		3		3
	20 sublingually	( )				
Doryl and urecholine	plus orally	3				3
Prostigmine	25 m					
	5 m					
	5 orally					
	20 orally	4	4			
	45 orally	(12)				
Mechoyl	200 orally plus					
	200 orally					

The effects of doryl urecholine, prostigmine, and mecholyl on gastric motility after complete vagotomy are summarized in Table I.

*Effect of doryl (carbamylcholine)* The administration of doryl 2 to 4 milligrams orally (Fig. 3) or 0.25 milligram subcutaneously (Figs. 4, 5) was usually followed by a marked increase in gastric motility.

Following oral administration, the increased motility was noted from  $\frac{1}{2}$  hour to  $1\frac{1}{2}$  hours later and lasted from 30 minutes to 3 or more hours. Following subcutaneous injection, the increased motility was noted in 5 to 10 minutes and lasted 30 minutes to 1 hour. There were no serious toxic effects although occasionally sweating salivation or abdominal cramps were noted. Two tests were terminated when 2.0 milligrams of doryl given orally produced no change in gastric motility in 1 hour. It was later determined that the stimulatory effect may not be noted for  $1\frac{1}{2}$  hours. This may have been the case in these tests, listed in Table I as No effect.

*Effect of urecholine (urethane of B-methylcholine)* The administration of 5.0 milligrams of urecholine subcutaneously was followed by

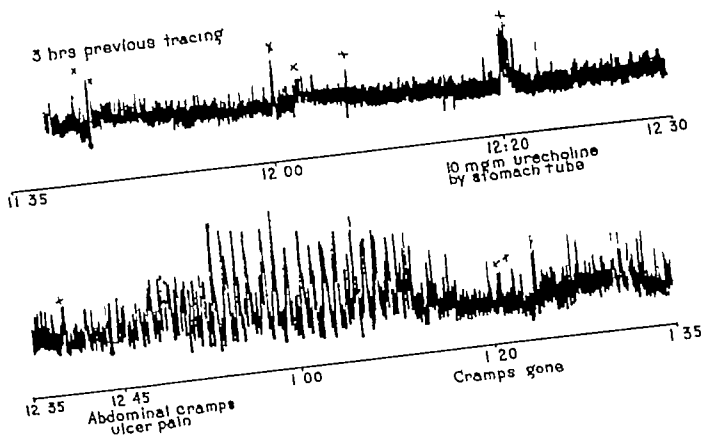


Fig. 6 Postoperative motility tracing showing the effect of 0.06 milligrams of urecholine by mouth.

increased gastric motility in 10 minutes, lasting 30 minutes to 1 hour. Ten milligrams by mouth usually produced increased gastric motility in 30 minutes to 1½ hours lasting 30 minutes to 3 or more hours (Fig 6). There were no serious toxic effects, although a few instances of sweating or abdominal cramps were noted.

**Combined effect of doryl and urecholine.** Two milligrams of doryl were given by mouth and 45 minutes to 1 hour later 10.0 milligrams of urecholine were given orally. A marked increase in gastric motility was noted soon after the urecholine was given, lasting at least 3 hours (Fig 7). There were no serious toxic effects.

**Effect of prostigmine.** In only 1 instance of 11 trials did prostigmine produce any change in the gastric motility. In this case 45.0 milligrams by mouth produced a marked increase in motility associated with severe abdominal

cramps. The intravenous injection of 0.6 milligram of atropine sulfate caused immediate cessation of both the cramps and increased gastric motility.

**Effect of mechoyl.** In 2 instances 200.0 milligrams of mechoyl by mouth produced no change in gastric motility. A second dose of 200 milligrams was given once at the end of 1 hour without effect.

**X ray studies.** A detailed report of these studies is to be published elsewhere (17). In general 2 weeks after complete vagotomy there was a marked delay in gastric emptying with a 50 to 70 per cent retention of barium in 4 hours. A gastroenterostomy was performed on 25 of the patients. In 8 instances it was done as part of previous surgical procedures in patients who later developed marginal ulcers. Gastric retention was present in patients with and without gastroenterostomy, but was greater in the latter group. Delay in emptying was less



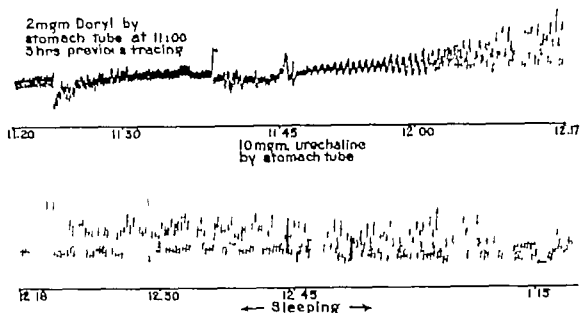


Fig. 7 Postoperative motility tracing showing the combined effect of 2 milligrams of doryl and 10 milligrams of urecholine by mouth.

marked after 3 months however after 9 months, delayed emptying was still present

#### DISCUSSION

Following complete vagus section there is a marked reduction of gastric motility and a prolongation of gastric emptying time. Early in this study oral feedings were started on the third or fourth postoperative day but following the case of gastric retention and dilatation mentioned earlier the regimen was changed to prevent any early distention of the stomach. Postoperatively continuous intragastric suction and parenteral fluids were maintained for 5 days. On the 6th and 7th days small feedings of clear liquids were given and on the 8th and 9th days small feedings of a general liquid diet were given. A soft diet was usually allowed on the 10th day. Since the postoperative care was changed delayed gastric emptying was still noted, but was less marked. In only a few

patients did symptoms of gastric distention require the therapeutic use of doryl or urecholine and no further cases of acute retention and dilatation were encountered. When used therapeutically either 2.0 to 4.0 milligrams of doryl or 10.0 milligrams of urecholine were given by mouth three times a day before meals. Parenteral administration either 0.25 milligram of doryl or 5.0 milligrams of urecholine subcutaneously was sometimes used first.

Additional treatment was unnecessary after a few days to a week. The patient who had acute gastric retention and dilatation previously mentioned was an exception and required more prolonged therapy. This patient had partial gastric retention after 24 hours and complained of foul belching. Treatment with doryl or urecholine was continued for 5 months after which time the patient was asymptomatic, although gastric emptying was still markedly delayed.

We have observed that both doryl and urecholine cause an increase in gastric acidity as well as an increase in motility. This stimulatory effect on gastric secretion of doryl has been previously noted by Noll and Goodman (4) and of urecholine by Machella. Recurrence of ulcer symptoms has not been noted in patients receiving these drugs either experimentally or therapeutically.

The pharmacological action of doryl and urecholine has been studied and reviewed by Starr and Ferguson. They conclude that although the therapeutic usefulness of the two drugs is similar doryl has a much stronger nicotine-like action than urecholine and is therefore more toxic.

Following complete vagus section, doryl or urecholine produces gastric motility simulating normal type I or type II hunger contractions, as well as increase in gastric tone. These hunger contractions differ from normal spontaneous hunger contractions in that they are more frequent and more regular but are of smaller amplitude.

#### SUMMARY AND CONCLUSIONS

The gastric motility of 27 patients with peptic ulcer has been studied before and after vagus section. By the method of motility study described it has been shown that no spontaneous or insulin induced type I, II, or III hunger contractions are present in the fundus of the stomach up to 9 months after complete vagotomy. There is a marked delay in gastric emptying following complete vagotomy. Delayed emptying is still present after 9 months. After incomplete vagus section hunger contractions are present either spontaneously or following insulin hypoglycemia.

Doryl 0.25 milligram subcutaneously or urecholine 50 milligrams subcutaneously,

produces a rapid but transitory increase in gastric tone and motility following complete vagotomy. The oral administration of doryl, 20 to 40 milligrams or urecholine 100 milligrams usually produces a more sustained increase in gastric tone and motility after complete vagus section. Prostigmine and mechlolyl have little if any effect on gastric motility after complete vagotomy.

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# INTRAPERITONEAL PRESSURE IN THE HUMAN

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**I**NTRAPERITONEAL pressure is one of the stresses thrown on a healing abdominal incision. This work was undertaken to measure intraperitoneal pressure and to determine the effect of such factors as position, movement, coughing, straining, and early ambulation.

In the literature there has been considerable controversy concerning intra abdominal pressure in humans. Emerson reviewed the literature in 1911 and found that a number of investigators reported a negative pressure and an equal number reported a positive pressure. From the rather scant details of this paper it seems that those reporting positive pressure had introduced balloons into the body orifices and those reporting negative pressures had introduced needles or trochars into the peritoneal cavity. Overholt and Lam pointed out that in a peritoneal cavity containing no free gas or fluid only a negative pressure will be registered when a needle or trochar is introduced as nothing enters the needle or trochar.

Overholt in 1931, Lam in 1939, and Rushmer in 1946 studied the abdominal pressure in animals using balloons introduced into the peritoneal cavity and agreed that intraperitoneal pressure is hydrostatic and depends on the position of the animal and on the vertical level at which pressure is measured.

It seemed to us that intraperitoneal pressure in humans could be accurately measured by balloons introduced into the peritoneal cavity and that these could be introduced and left without harm at the end of such abdominal operations as those requiring drains and in those for penetrating abdominal wounds. No harm has occurred to any patient so studied.

## METHODS

A rubber condom was cut off at its open end so as to hold 60 to 100 cubic centimeters of air.

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without resistance and was tied over the end of a urethral catheter. The catheter was brought out through a stab wound and in the earlier experiments the balloon was placed free in the peritoneal cavity. It was found that the balloon gravitated to the pelvis so in later experiments the position of the balloon was fixed by a suture passed through the abdominal wall around the catheter near the balloon and tied outside. In some cases two balloons were introduced, one in the upper abdomen and one in the lower. The position of all balloons was checked by roentgenograms.

Pressure was measured by a U manometer containing water or bromoform. The latter is a heavy fluid and was used in recording the higher pressures. All pressures are reported in centimeters of water. To measure the intraperitoneal pressure the balloon was first inflated with air to its full capacity of 60 to 100 cubic centimeters. It was then completely emptied and 5 cubic centimeters injected at a time and the pressure recorded. It was usually found that any volume between 5 and 25 cubic centimeters could be injected without varying the pressure more than 1 centimeter of water. In all cases an amount was injected so that 5 to 10 cubic centimeters more or less caused a change of pressure less than 1 centimeter of water.

In some cases the pressure was read off the manometer; in others kymograph tracings were made.

## RESULTS

With the subject supine the intraperitoneal pressure was found to average 8 centimeter of water in 9 patients with 30 separate recordings and there was no difference in pressure in the upper and lower abdomen (Fig. 1). With the subject erect the pressure in the upper abdomen was found to remain about the same. In the lower abdomen the pressure increased almost 3 times its supine value (Fig. 2). In one subject in which the upper balloon was located just beneath the dome of the left dia-



Fig 1. Intrapertoneal pressure with patient at rest in supine position.  $\pm$ , Lower abdomen 8, upper abdomen. Average pressure upper abdomen, 8 centimeters of water; lower abdomen, 7.5 centimeters of water.

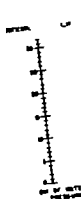


Fig 2. Intrapertoneal pressure with patient at rest in erect position.  $\pm$ , Lower abdomen 19, upper abdomen. Average pressure upper abdomen, 7 centimeters of water; lower abdomen 19 centimeters of water.

phragm the pressure actually dropped a little (Fig 3)

In comparing pressures taken at two different vertical levels by using two balloons in the same peritoneal cavity, it was found that the greater the distance between the vertical levels the greater the difference in pressure (Fig 4). The relationship is closer than shown as the distances were simply measured off as shown on an x ray film taken at 36 inches which magnified the distance. This confirms the findings of Lam Overholt and Rushmer who from data in animals concluded that intraperitoneal pressure was a hydrostatic one

## EFFECT OF EFFORT

The most marked increases were due to coughing and vomiting. One patient (J P) with a hard cough blew the fluid out of a manometer with a limit of 150 centimeters. This was partly overshoot but since another patient (C J) maintained a pressure of 80 centimeters while retching we feel that the 150 was not unreasonable (Table I).

Table I shows the average actual pressures attained and the average increases over supine pressures in various activities. The pressure attained in getting out of bed (29 cm) and

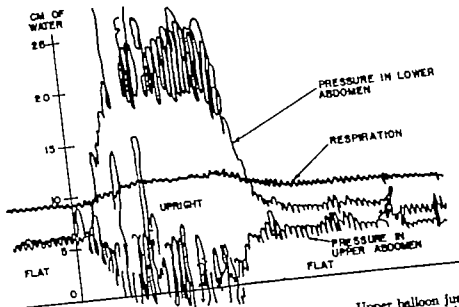


Fig 3. Effect of posture on intraperitoneal pressure. Upper balloon just beneath left diaphragm. Change of position on electrically driven tilt table T.L. Fourth day after operation.

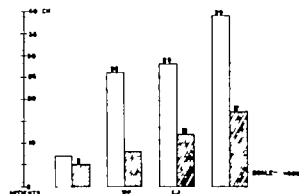


Fig. 4. Difference in pressure at different vertical levels with patient in the erect position. White space, distance between upper and lower balloons. Crosshatched space, difference in pressure (cm of water) in upper and lower balloons. F.W. upper balloon just below superior spine of ilium. W.T. upper balloon at level of twelfth thoracic vertebra. L.J. upper balloon at level of eleventh thoracic vertebra. T.L. upper balloon at level of fifth intercostal space.

walking (18 cm) does not approach the pressure increase in such unavoidable activities as vomiting (80 cm) and coughing (62 cm) when supine. The highest single pressure recording as was mentioned before was 150 centimeters attained on coughing.

The intensity of effort in such a voluntary act as straining at stool can be controlled by the patient and it is probable that he can partly control the intensity of such acts as getting out of bed. A patient with little pain is more likely to strain and cough hard and to

TABLE I.—EFFECT OF EFFORT ON INTRAPERITONEAL PRESSURE  
(Cm. Water)

	Average		
	Actual pressure	Increase over supine pressure	No. patients
Semi-Fowler position		4	3
Full Fowler position	14	8	
Arising from bed to standing	40	30	6
Walking	6		3
Sitting in chair	7	8	6
Getting into bed	36		
Getting on bedpan	9	9	
Vomiting while on bedpan	3	3	3
Defecation while on commode	34	33	
Straining at stool while on commode		33	3
Coughing	6	33	6
Vomiting	80	73	

move abruptly. These factors affect the intraperitoneal pressure. However it is seen in Table I that on an average the acts of straining at stool, getting on bed pans and defecating cause about the same increase as getting out of bed and walking.

It must be remembered however that intraperitoneal pressure is only one of the stresses thrown on an abdominal wound, the other most important one being muscle pull. It is

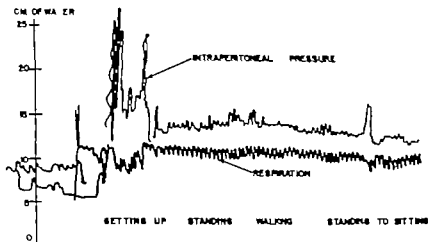


Fig. 5. Effect of effort and posture on intraperitoneal pressure. Balloon located just to left of umbilicus. J.P. Third day after operation.

likely that the abdominal muscles can be strongly contracted without greatly increasing the intraperitoneal pressure. However from the above data we can say that the increase of intraperitoneal pressure due to walking and rising does not throw a significant stress on the healing wound.

#### EFFECT OF ABDOMINAL DISTENTION

It is difficult to assess abdominal distention. In the 1 patient (W F) whose abdomen was definitely but not severely distended the supine intraperitoneal pressure was 1 centimeters. It seems reasonable to assume that a large amount of intestinal gas would increase the intraperitoneal pressure.

#### EFFECT OF RESPIRATION

In general there were fluctuations of pressure of 2 to 4 centimeters with respiration. In 2 patients in which the pressure was read from the manometer the intraperitoneal pressure decreased on inspiration. On all those in which kymograph tracings were made and simultaneous ordinants obtained the pressure rose on inspiration. It is suggested that the type of fluctuation depends on the predominance of the type of respiration, i.e. diaphragmatic or intercostal. Overholt found this to be true in animals.

#### EFFECT OF PNEUMOPERITONEUM

We do not believe that the amount of air introduced into the peritoneal cavity at the time of operation was significant in our work. In measurements taken over a period of a week there was no progressive decrease in pressure as the air was absorbed.

Further it was found that when 40 to 70 cubic centimeters of air was injected into one of two balloons in a peritoneal cavity the pressure in the other balloon did not change. More air was not injected because of the pro-

duction of pain. This same experiment was carried out in 2 patients.

#### CONCLUSIONS

1 A safe accurate method of measuring intraperitoneal pressure in humans is presented.

2 Intraperitoneal pressure has been studied in the human during the first postoperative week.

3 In the supine position the intraperitoneal pressure is about 8 centimeters of water in both the upper and lower abdomen.

4 In the erect position the pressure in the upper abdomen is about 8 centimeters of water. The pressure in the lower abdomen is about 20 centimeters of water. The greater the vertical distance between the two points measured the greater is the difference in pressure.

5 Involuntary action such as coughing, vomiting and straining at stool elevates the pressure to levels as high as 80 centimeters of water which is a much greater elevation than that caused by arising and walking.

6 Early ambulation does not increase the intraperitoneal pressure enough to make it a significant stress on the abdominal incision.

NOTE.—Our interest in intraperitoneal pressure was stimulated not only by the apparent advantages of early ambulation but also by a personal experience in 1947 following a right inguinal herniorrhaphy. My own experience with early ambulation at the time demonstrated that patients had much less pain in the incision when attempting to void in the erect position or defecate on the toilet than when attempting to perform either of these functions in the supine position in bed. The pain in the incision was quite obviously due to contraction of the abdominal muscles in an attempt to increase intra-abdominal pressure and it was apparent that, in the erect position patients had much less tension on the incision than when lying flat in bed. This impression has, I believe, been confirmed by Dr. Drye's experiments.

R. Arnold Griswold

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# EDITORIALS

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OCTOBER, 1948

### THE SURGICAL SIGNIFICANCE OF INDETERMINATE PUL- MONARY LESIONS

THE development of curative surgical treatment for lesions within the chest has been almost entirely accomplished within the past three decades. Prior to that time intrathoracic surgery consisted chiefly of the drainage of infections. The diagnosis of lesions within the thorax began somewhat earlier and was enhanced by the discovery of the x ray by Roentgen in 1895 and the use of the bronchoscope by Killian in 1897. These diagnostic aids for a time set the pace for therapy. In recent years, however, adequate anesthesia, blood and other parenteral fluid therapy, chemotherapy, and the development and improvement in surgical technique have advanced surgical management to a very high degree. This stage of development was forecast by Adler in 1912 when he wrote: "There is every reason to hope that the technique of this new branch of surgery will be still further developed and that in the near future thoraco-

tomy and operations on the lungs will be attended by no more risk than peritoneal operations today. When all the means of diagnosis outlined in this little study fail where there are suspicions of tumor but no assurance is possible, there should be—it is emphatically here stated—as little hesitation in resorting to an exploratory thoracotomy as there is now in submitting to an exploratory laparotomy." That the risk of exploring the thorax is now very little when the fundamental principles are observed is most fortunate, since in spite of many improvements in diagnostic methods there still remains a considerable proportion of inflammatory, neoplastic, and congenital intrathoracic lesions which defy all attempts at diagnosis.

In the earlier course of the development of this field of surgery when the operative approach was made with considerable hesitation and risk, diagnosis depended to a considerable extent on the clinical history and findings. Refinements in x ray diagnosis awaited further development and recognition of the lesion was not forthcoming until an advanced stage had been reached. Unfortunately all too frequently this delay necessitated a much more radical type of surgery, if indeed more than an exploratory thoracotomy could be performed.

Although the clinical history and findings continue to play an important part in diagnosis, they frequently fall far short of an adequate means on which to base proper surgical management. Roentgenograms and bronchograms when properly employed are perhaps our best means of identifying intrapulmonary lesions. When these are combined with bronchoscopic observation and biopsy, pneumothorax and bronchial secretion examination

the true nature of the lesion may be found in a high percentage of cases. The difficulties of diagnosis in the early and uncomplicated stage of the lesion have increased in number in recent years with the routine roentgenologic or fluoroscopic examination of the chest of employees of many industrial, educational, and other institutions. At this early stage no symptoms have been experienced and the physical examination reveals no apparent abnormality. The responsibility of deciding at that time as to proper therapy is much greater because frequently all means of diagnosis fail to determine the nature of the lesion. Further, it is at this early date that proper therapy should be instituted since in the case of malignancy the prognosis for a long time cure is quite good. All too frequently however the lesion is viewed as insignificant since it has given rise to no symptoms. The physician, as well as the patient, is given a false sense of security by the fact that symptoms and altered physical findings are absent.

What are some of the more common lesions which present this problem of diagnosis and early therapeutics? One of the more common conditions in which a delay in diagnosis is of prime importance is primary carcinoma of the lung. Approximately from 25 per cent to 35 per cent of these lesions arise in the periphery of the lung, away from the main bronchi. At an early stage they appear as a circumscribed opacity and produce no symptoms. Their rate of growth is variable but many may be present for a number of months or even years before their presence is manifested. When found on fluoroscopic or x ray examination these lesions are frequently mistaken for tuberculosis. This error is made especially because of the slow rate of growth of the lesion and the appearance at times of small cavities within the opaque area. In spite of the fact that the sputum if present, remains negative

for tubercle bacilli the diagnosis of tuberculosis may be entertained for a long period of time.

Peripheral tumors frequently undergo central necrosis with cavity formation. Infection follows and leads to the production of signs and symptoms of a lung abscess. At one time it was thought that these peripheral lesions carried a poor prognosis. This conclusion was based on the fact that the lesion was far advanced when symptoms first developed and the condition was first recognized. It is now known that, if the tumor can be identified before symptoms have been produced, the prognosis for a long time cure following extirpation is very good. When it is appreciated that almost one-third of primary lung cancers arise in the peripheral region, the importance of early exploration after a reasonable period of study to rule out other conditions will improve the outlook for this lesion in a high percentage of cases. It has been our experience at the University of Chicago Clinics that the peripheral group of primary lung cancer when diagnosed and explored at an early date has a much better chance for a long time cure than have those tumors arising in the main stem bronchi. Examination of the bronchial secretions will give positive results in some cases. The lack of facilities for using this method of diagnosis should never delay the prompt institution of proper surgical therapy. Since exploratory thoracotomy in itself carries very little risk, these patients should receive its benefit rather than have proper treatment delayed until a chance for cure is past.

In other patients primary lung tumors are frequently diagnosed as unresolved pneumonia, virus pneumonia or pneumonitis. This mistaken diagnosis is particularly apt to be made when the lesion is in the upper lobe and therefore cannot be visualized through a bronchoscope. A study of the bronchial se-



cretions may be indeterminate. If there is no specific evidence to support the diagnosis of unresolved pneumonia or pneumonitis the likelihood of malignancy should be strongly considered and investigated without delay. At the present time through the use of chemotherapeutics, most pyogenic infections of the lung will respond in a reasonable length of time. Since the risk of lung resection has been reduced to a very reasonable level this form of treatment should be considered if the diagnosis cannot be otherwise ascertained. The incidence of carcinoma of the lung is so much greater than that of chronic pneumonitis or unresolved pneumonia that the chance of resecting a nonmalignant lesion is unlikely.

During recent years a congenital abnormality of the lung i.e. cystic malformation has been more frequently recognized. This condition produces symptoms usually after the involved region has become infected. The clinical picture at times is not unlike that of lung abscess, tuberculosis or primary lung tumor. In most cases differentiation is possible. However at times since the lung becomes airless x ray examination and other means of diagnosis fail to reveal the true nature of the condition. When these patients are properly prepared for operation by the use of chemotherapeutic agents blood transfusion and other replacement therapy exploration is attended with little risk and the lesion can be dealt with in a satisfactory manner.

Mediastinal tumors, chronic inflammations and congenital cysts are sometimes difficult to recognize or to differentiate from lesions arising in the lung. Many of these lesions remain entirely asymptomatic until through pressure on adjacent structures a pulmonary infection is produced or there is interference with the function of the adjacent organs. The clinical features and x ray findings are virtually the only means on which to base a

working diagnosis. If the lesion can be dealt with before complications arise the problem of satisfactory treatment is not nearly so great and the morbidity is considerably reduced. Mediastinal dermoids bronchogenic cysts, and congenital abnormalities of the vessels of the mediastinum fall into this group. Mediastinal dermoids are prone to undergo malignant degeneration and thus present an additional indication for exploration and removal at a time when they may seem innocuous due to the fact that no symptoms have been produced.

Much progress has been made in the operative care of intrapulmonary lesions. If the benefit of early exploration in patients with indeterminate lesions is kept in mind the outlook for pulmonary malignancy will be much improved.

W. E. ADAMS.

## PRESENT STATUS OF PULMONARY DECORTICATION

THE present interest in pulmonary decortication is an outgrowth of experience acquired during World War II. Military surgeons when faced with the problem presented by massive clotted and organizing pleural accumulations under which lungs were collapsed accepted the challenge by opening the thorax removing the pleural content and stripping from the visceral pleura the confining envelope of organized fibrin.

As experience accumulated there evolved the concept of a lung retained in a state of collapse by peripleural fibrous or fibrinous investments independent of any gross intra pleural mass. The operative procedure itself was amplified to include not only the removal of restraining pleural peels but also a complete mobilization of the lung so that it could lie free within the thorax and be unhampered in expansion. Thus, it was capable of completely filling its hemithorax in a very brief period of time.

This present day concept of decortication contrasts with the operative procedure carried out by Delorme, Ransohoff, and others. These pioneers, working in an infected field and without the protection of modern adjuncts to surgery, were forced to keep their dissections from violating uncontaminated pleural recesses. When confronted with persistent intrapleural spaces, therefore, they carried the chest wall to meet the collapsed lung but by thinning or removing the thick visceral peel they utilized what expansibility of lung they could muster in order to lessen the final gap between the lung and chest wall. Whereas these men resorted to decortication late in the course of disease, the modern approach calls for relatively early exhibition of the procedure.

The basic indication for pulmonary decortication lies in a lung that cannot re-expand because it is held in the collapsed position by peripleural investments. Each of the following factors must be considered: (1) the bronchial tree must be patent so that air can enter the lung freely, (2) the lung itself must be intrinsically capable of expansion, (3) the content of the pleura must be displaceable or removable in order to demonstrate that its mere presence is not maintaining collapse, and finally (4) there must have existed a pleural process capable of laying down a restraining peripulmonary deposit.

To determine patency of the air passages bronchoscopy is required. Thoracentesis can generally demonstrate the nature of the pleural content as well as its displaceability. The inherent ability of the lung to expand can only be appraised by clinical evaluation which needless to say may involve extensive investigation. Any lung which fails to expand after removal or effective neutralization of its pleural factor must be considered as captive on a mechanical basis if its bronchial tree is patent and its intrinsic expansibility is assured.

Considering in more detail the pleural factors it should be recalled that inaspirable (solid or semisolid) pleural accumulations are usually fibrinous in nature and maintain collapse by their bulky presence, and that the mere removal of this pleural mass is not likely to suffice in promoting pulmonary re-expansion because a perivisceral envelope of organized fibrin is probably present if the process is a week or more old. In the presence of a bronchopleural fistula adequate neutralization of the pleural factor (air) may not be possible because it is being constantly replaced. Likewise any pleural process which produces fluid continuously must be looked upon with suspicion because a true retaining cicatricial peel is not capable of significant secretory or transudative activity. Although continued production of pleural fluid can occur concomitantly with the deposition of a retaining peel, it is not likely that under these circumstances the mechanical retention of the lung in the collapsed state will be an important feature of the clinical problem. Pleural neoplastic implants for example frequently behave in this manner.

In addition to these basic considerations one additional requirement must be satisfied namely that the process responsible for the production of the collapsed and captive lung is controlled or quiescent, or at least that it can be controlled at the time of decortication.

Acute pyogenic empyemas do not generally provide the basic indication for decortication because adequate management of the pleural factor (which must include dependent drainage) usually results in pulmonary re-expansion even though this may occur slowly. The more indolent pleural infections on the other hand such as are occasionally seen in pleurae surgically contaminated by staphylococci may require aggressive treatment because of copious production of heavy fibrinous pleural



# THE SURGEON'S LIBRARY

## REVIEWS OF NEW BOOKS

THE Swiss obstetricians and gynecologists recently decided to prepare textbooks of obstetrics and gynecology themselves instead of depending upon German and French textbooks. Guggenberger and his associates wrote the textbook of gynecology and the two volumes which constitute the textbook of obstetrics were prepared by Koller with the assistance of nine other Swiss obstetricians who teach and practice in Basel, Zurich and Geneva. The book was written in German. There will be a third book devoted to operative obstetrics.

There are 1,323 pages in the two volumes and 711 illustrations. Of the 1,261 pages of text (the remaining 62 pages are devoted to the index) 180 pages or exactly one-seventh of both volumes are given over to fetal monstrosities (100 pages) and pathology of the newborn (80 pages). Likewise, 143 of the 711 illustrations or one fifth of all the illustrations, pertain to abnormalities of the newborn. The amount of space devoted to the newborn (aside from the chapter on the physiology of the newborn) seems disproportionately great. Many illustrations have been borrowed or copied from other textbooks but all of them are excellent.

The authors describe and illustrate methods of resuscitating newborn babies including Schultze's swappings. These procedures are dangerous and should not be used. Likewise there is a detailed description and two illustrations of the Credé method of expressing the placenta, but this manipulation can do great harm and should be forgotten. We have far safer ways of expressing the placenta.

As in the United States the author (Held) agrees that in cases of pre-eclampsia if improvement does not follow conservative treatment, the uterus should be emptied by induction of labor from below or by cesarean section. However in cases of eclampsia three forms of therapy are described namely active conservative, and "middle line." Koller prefers the "middle line" treatment of eclampsia and advises against cesarean section. Most obstetricians in the United States also favor conservatism for nearly all cases of eclampsia.

In cases of placenta previa, chief reliance is placed upon the transperitoneal cervical cesarean section for the serious cases and rupture of the membranes for the mild cases. The author (Koller) properly cautions against forcible dilatation of the cervix in cases of placenta previa.

The ten authors of this book are to be congratulated on having written an excellent textbook. Naturally the style is not uniform, but all the authors have presented their subjects in simple lucid language. The advice given is nearly always conservative and in accordance with the practice of leading obstetricians everywhere in the world. The illustrations are well chosen, abundant and highly instructive. The publishers also are to be commended for the paper is good, the type is clear and the illustrations have been clearly reproduced. This textbook will undoubtedly be very popular not only in Switzerland, but also in other parts of the world where physicians and students read German.

J. P. GREENHILL.

THE authors of *Nouvelles techniques de traitement des fractures* give a fairly complete review of recent developments in fracture treatment by the use of open and closed methods. The principal theme is their use of Kirschner wires to secure fragments by transverse or intramedullary fixation. They describe their animal experiments to show that Kirschner wire fixation causes little interference with bone healing. They also depict a reducing frame which permits the use of traction in any direction, as well as a number of special wire guides which they have devised.

A preface by their teacher, Prof. J. Leveuf of the University of Paris, states that the authors are the originators of the method of Kirschner wire fixation "with the minimum of surgery." This is in keeping with the ideals of their common mentor, Pierre Delbet, who constantly strove for preservation of function while securing union of the fractures.

Each type of fracture in the body is considered and the latest developments in treatment are described. Some old material is used, such as the various reconstruction operations of the hip and the different types of bone grafts. On the other hand much attention is paid to the newer methods of intramedullary pin fixation of fractures.

The book is well planned and the illustrations are good but there are very few bibliographic references to correspond to the names mentioned in the text. While this is a fault it can be excused as they say it was published in a difficult period when library facilities were far from adequate.

WALTER G. STUCK.

LEHRBUCH DER GEBURTSHILFE. Vols. 1 and 2. By Th. Koller. Basel, Switzerland: S. Karger, 1942.

NOUVELLES TECHNIQUES DE TRAITEMENT DES FRACTURES. By H. Godard and R. Michel-Betbet. Paris: G. Doin & Cie, 1942.



THE textbook of physiology *Human Physiology*<sup>1</sup> edited for medical students by two teachers at University College London is an astonishingly complete treatment of the subject in 564 pages of material. Chapters have been contributed by Pickering Mackay Gregory, Smyth Young, Newton, P. Eggleston, Whitteridge, Feldberg, Lythgoe, Rawdon Smith and M. G. Eggleston nevertheless the multiple authorship is less evident than is the case for most compendia as the editors have succeeded admirably in achieving a homogeneity of style. It is probably inevitable that some chapters are superior to others in the extent and clarity of the exposition but there is no segment of the vast field of physiology that is neglected. One of the techniques utilized in achieving comprehensiveness with minimal verbiage is the intrusion of definitions etc. as parenthetical material. The following examples are illustrative: a reduction of the alkali reserve (acidosis) red cells may clump together (agglutinate) mictitating

membrane (a third eyelid present in some species). To attain economy of space there is little or no bibliographic material but there is a surprisingly great amount of illustrative material in the form of figures, diagrams and charts. Many of these are excellent but a few (time-worn heritages of earlier texts) could be dispensed with without penalizing the quality of the book.

In general the book is not directed toward being an applied physiology in the sense that it is primarily devoted to the exposition of clinical phenomena but in the opinion of the reviewer this is an asset rather than a liability. Clinical applications (where important) are dealt with but there is no evasion of the material for which as yet, the clinical counter parts are missing. It is a praiseworthy addition to the library of this field.

CARL DRAGSTEDT

*HUMAN PHYSIOLOGY*. By F. R. Winton, M.D. D.Sc., and L. E. Bayliss, Ph.D. 3rd ed. Philadelphia, Toronto: The Blakiston Co. 1948.

## BOOKS RECEIVED

Books received are acknowledged in this department, and such acknowledgment must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interests of our readers and as space permits.

*GENERAL ENDOCRINOLOGY*. By C. Donald Turner. Ph.D. Philadelphia and London: W. B. Saunders Co., 1948.

*RECENT ADVANCES IN SURGERY*. By Harold C. Edwards, C.B.E., M.S., F.R.C.S. 3rd ed. Philadelphia: The Blakiston Co. 1948.

*MEDICAL WRITING: THE TECHNIQUE AND THE ART*. By Morris Fishbein, M.D. 2nd ed. Philadelphia and Toronto: The Blakiston Co. 1948.

*MODERN TRENDS IN DIAGNOSTIC RADIOLOGY*. Edited by J. W. McLaren, M.A., M.R.C.S., L.R.C.P., D.M.R.E. New York and London: Paul B. Hoeber Inc., 1948.

*ORAL SURGERY*. By Kurt H. Thoms, D.A.M.D. Vols. 1 and 2. St. Louis: The C. V. Mosby Co. 1948.

*TEXTBOOK OF SURGICAL TREATMENT INCLUDING ORAL AND MAXILLOFACIAL SURGERY*. Edited by C. F. W. Illingworth. 3rd ed. Baltimore: The Williams and Wilkins Co. 1947.

*BREAST FEEDING*. By F. Charlotte Nalab. London: New York, and Toronto: Geoffrey Cumberlege, Oxford University Press, 1948.

*RECENT ADVANCES IN ANESTHESIA AND ANALGESIA*. By C. Loughton Hewer. 6th ed. Philadelphia and Toronto: The Blakiston Co. 1948.

*RECENT ADVANCES IN OBSTETRICS AND GYNAECOLOGY*. By Alick W. Bourne and Leslie H. Williams. 7th ed. Philadelphia and Toronto: The Blakiston Co. 1948.

*SUCCESSFUL MARRIAGE*. Edited by Morris Fishbein, M.D. and Ernest W. Burgess, Ph.D. Garden City: Doubleday and Co. Inc. 1948.

*PREOPERATIVE AND POSTOPERATIVE CARE OF SURGICAL PATIENTS*. By Hugh C. Eigenfritz, A.B., M.D., F.A.C.S. St. Louis: The C. V. Mosby Co. 1948.

*A MANUAL OF PRACTICAL OBSTETRICS*. By O. Donel Browne, M.B., M.A.O., M.A., LITT.D., F.R.C.P.I., F.R.C.O.G. 2nd ed. Baltimore: The Williams and Wilkins Co. 1948.

*THE SURGERY OF THE COLON AND RECTUM*. By Sir Hugh Devine and John Devine. Baltimore: The Williams and Wilkins Co. 1948.

*STANDARDS FOR THE DIAGNOSIS AND TREATMENT OF CANCER*. By the Cancer Committee of the Iowa State Medical Society. Iowa City: Athens Press, 1948.

*ANATOMY OF THE HUMAN BODY*. By Henry Gray, F.R.S. 25th ed. Edited by Charles Mayo Goss, M.D. Philadelphia: Lea & Febiger. 1948.

*ZIMMER'S TEXTBOOK OF BACTERIOLOGY*. Revised by David T. Smith, M.D., Donald S. Martin, M.D., M.P.H., Norman F. Conant, Ph.D., Joseph W. Beard, M.D., Grant Taylor, M.D., Henry I. Kohn, Ph.D., M.D., and Mary A. Poston, M.A. 9th ed. New York: Appleton Century Crofts, Inc., 1948.



York University Post-Graduate Division, and chairman of the Committee on Fractures and Other Traumas of the American College of Surgeons

#### PRESIDENTIAL MEETING

The opening evening session of the Clinical Congress will be devoted to the Presidential Meeting at which the officers-elect, consisting of Dr Dallas B Phemister of Chicago as president, Dr Howard A Patterson of New York as first vice president and Dr Carl H McCaskey of Indianapolis as second vice president will be installed. Dr Arthur W Allen of Boston outgoing president and vice-chairman of the Board of Regents will preside and will deliver the Presidential Address on the subject "Looking Forward." The third Martin Memorial Lecture will be delivered by Dr Clarence Crafoord professor of surgery, University of Stockholm. Dr Crafoord's subject will be "Some Aspects of the Development of Intrathoracic Surgery."

#### CONVOCATION

The Annual Convocation will be held on the final evening Friday. The formal initiation ceremonies and the presentation of the Fellowship Address by Dr George W Beadle Professor of Biology and chairman Department of Biology, California Institute of Technology Pasadena, will constitute the program. Dr Beadle's subject will be, "Hereditary Errors in Metabolism."

#### ASSEMBLY OF INITIATES

The 1948 initiates will attend an assembly on Friday afternoon from 1:30 to 2:15 o'clock in the Temple Baptist Church. Dr Dallas B Phemister incoming president of the College, will preside. Dr Irvin Abell chairman of the Board of Regents and Dr Malcolm T MacEachern Dr H Prather Saunders and Dr Charles F Branch will briefly outline the program of the College.

#### OTHER OFFICIAL MEETINGS

The annual meeting of the Governors and Fellows of the College will be held on Thursday afternoon at 1:30 o'clock. Reports on activities of the American College of Surgeons will be presented by the officers and chairmen of the standing committees, followed by the election of officers.

Meetings of three important committees will be held on Wednesday as follows: State and Provincial Executive Committees, 9:00 to 10:00 a.m.; State and Provincial Credentials Committees and Committees on Applicants and Judiciary Committees, 10:00 to 11:00 a.m. and National and

Regional Fracture Committees 3:30 to 5:00 p.m. The Committee on the Library will meet on Thursday from 3:00 to 4:00 p.m. A dinner for the members of the Committee on Fractures and Other Traumas, and for the chairmen of the Regional Committees will be held from 6:00 to 8:00 p.m. on Thursday.

#### FORUM ON FUNDAMENTAL SURGICAL PROBLEMS

The Forum on Fundamental Surgical Problems one of the most popular features of Clinical Congresses during the past few years will be held on Tuesday through Friday mornings, in two sections meeting concurrently. Brief reports of original clinical and experimental observations relating to the broad aspects of surgery and the surgical specialties will be presented, under the general direction of Dr Owen H Wangensteen chairman of the committee, Forum on Fundamental Surgical Problems.

#### GENERAL SURGERY

In general surgery the program at the headquarters hotel will embrace three evening symposia and seven afternoon panel discussions.

On Thursday afternoon there will be only one panel discussion from 3:30 to 5:00.

Detailed programs are published on succeeding pages.

#### SURGICAL SPECIALTIES

Panel discussions on the surgical specialties will be held on Friday afternoon from 1:30 to 4:45 o'clock. The panels will be held concurrently in the following fields: urology, orthopedic surgery, neurologic surgery, gynecology and obstetrics, thoracic surgery and plastic surgery. Programs are shown on succeeding pages.

#### OPHTHALMOLOGY

The program for ophthalmologists will consist of two evening sessions, three morning panel discussions from 9:00 to 10:30 and an evening session on Wednesday in which a combined program with the otorhinolaryngologists will be held.

#### OTORHINOLARYNGOLOGY

The program in otorhinolaryngology will consist of two evening meetings, an evening session on Wednesday in which a combined program with the ophthalmologists will be held and three morning panel discussions from 10:45 to 12:15. The fact that the morning panel discussions are planned to follow those on ophthalmology will enable surgeons who combine these specialties in their practice to attend both sessions.



## SYMPOSIUM ON CANCER

On Tuesday afternoon from 2:00 to 5:00 a Symposium on Cancer Is Curable will be held at which surgeons will report on series of cancer survivals, without recurrence, of from five to twenty five years, and the College will report the additions to its Archives of Cancer Cures.

On Wednesday afternoon from 2:00 until 5:00 o'clock a Symposium on Cancer with Dr. Grantley W. Taylor of Boston, chairman of the Cancer Committee American College of Surgeons, presiding is scheduled. The list of subjects together with the speakers is published on another page.

## SYMPOSIUM ON FRACTURES AND OTHER TRAUMAS

Dr. Robert H. Kennedy of New York, chairman, Committee on Fractures and Other Traumas, will preside at the Symposium on Fractures and Other Traumas which will be held on Tuesday from 2:00 to 5:00 p.m. The speakers are listed in the outline of the program which appears on succeeding pages.

## SYMPOSIUM ON GRADUATE TRAINING IN SURGERY AND THE SURGICAL SPECIALTIES

Dr. Frederick A. Collier of Ann Arbor, chairman, Committee on Graduate Training in Surgery of the College will preside at the Symposium on Graduate Training in Surgery and the Surgical Specialties which will be held on Thursday afternoon from 3:00 to 5:00 o'clock.

## HOSPITAL STANDARDIZATION CONFERENCE

The first formal session of the Clinical Congress will be the opening meeting of the twenty-seventh Hospital Standardization Conference at 10:00 o'clock on Monday morning October 18. The plans for this meeting are described on a preceding page under the heading "General Assembly" and the preliminary outline of the program is included in a later section.

The hospital conferences will continue on Monday afternoon, with sessions following on Tuesday, Wednesday and Thursday mornings, after noons, and evenings, and all day Friday when visits will be arranged to hospitals in Los Angeles and vicinity with the cooperation of the Southern California Hospital Council, to study special features and observe procedures in general.

Hospital administrators, members of governing boards, medical staff members, heads of the various hospital departments and their personnel, nurses, dietitians, medical records librarians, and many other persons directly concerned about hospital progress, will be interested in the timely discussions of a wide range of hospital problems.

Aiding with the program are the following members of the Hospital Standardization Conference committee: Ritz E. Heerman, superintendent, The California Hospital; chairman Paul C. Elliott, superintendent Hollywood Presbyterian Hospital and President, Southern California Hospital Council; and Alden B. Mills, administrator Huntington Memorial Hospital, Pasadena.

A joint session with the American Association of Medical Record Librarians will be held on Wednesday afternoon. A forum on fundamental administrative problems, with administrative interns and graduates of the schools of hospital administration as the participants will be held on Thursday afternoon.

The evening meetings will be as follows: Tuesday evening a round table conference on Hospital Standardization and the Point Rating System; Wednesday evening a forum for hospital trustees and administrators; Thursday evening a panel discussion on "Nursing the Patient" with the subject presented from various points of view.

## COMMITTEE ON ARRANGEMENTS

A list of the members of the Committee on Arrangements for the Clinical Congress in Los Angeles follows:

## General Committee

Donald G. Tollefson, M.D. F.A.C.S., *Chairman*  
Hugh T. Jones, M.D. F.A.C.S., *Vice Chairman*  
Harold Lincoln Thompson, M.D. F.A.C.S. *Secretary-Treasurer*  
Gilbert J. Thomas, M.D. F.A.C.S. *Represent of the College*  
F. Vincent Askey, M.D. F.A.C.S.  
Max W. Bay, M.D. F.A.C.S.  
J. MacKenzie Brown, M.D. F.A.C.S.  
Lawrence Chaffin, M.D. F.A.C.S.  
A. Ray Irvine, M.D. F.A.C.S.  
Maurice Kahn, M.D. F.A.C.S.  
W. E. MacPherson, M.D.  
B. O. Raubison, M.D.  
Louis J. Regan, M.D.  
Carl Rucche, M.D., F.A.C.S.  
Stafford Wren, M.D.

## Committee for the Southern California Chapter

Ray B. McCarty, M.D. F.A.C.S., *Riverside*  
Meredith G. Benzer, M.D. F.A.C.S., *Redlands*  
Clarence E. Rees, M.D. F.A.C.S., *San Diego*  
Carl G. Johnson, M.D. F.A.C.S., *Long Beach*  
James H. Saint, M.D. F.A.C.S., *Santa Barbara*

## Hospital Committee

The members of the hospital committee are listed on succeeding pages with the list of hospitals participating in the clinical program.

## MEDICAL MOTION PICTURES

An appreciated feature of the Clinical Congress will again be the showing of medical motion pictures.

es each day. The latest available pictures on surgery and related subjects will be presented. Special showings will be arranged of medical motion pictures in the fields of ophthalmology and otolaryngology. Both sound and silent films will be shown all of which will have been approved by the Committee on Motion Pictures. Some of the newer medical motion pictures now under production will be shown.

#### TECHNICAL AND SCIENTIFIC EXHIBITIONS

The Technical and Scientific Exhibits will occupy the Ballroom foyer, the Renaissance Room and the Galleria of the Biltmore Hotel according to present plans. Leading manufacturers of surgical instruments, x ray apparatus, sterilizers, operating room lights, ligatures, dressings, hospital apparatus supplies, and pharmaceuticals and publishers of medical books will be represented.

#### ENTERTAINMENT FOR LADIES AND GUESTS

The Committee on Arrangements is planning a most interesting program for the wives and other guests of Fellows who are attending the Clinical Congress. Among the events planned are motor tours in and around Los Angeles to include such attractions as the Huntington Library, Griffith Park, Planetarium, Olvera Street, Chinatown, visits to Hollywood studios and homes of motion picture stars and radio broadcasts. Tickets to the broadcasts will be available upon request only at the registration desk at the Biltmore Hotel.

There will be a separate charge for each of the entertainment events. Each Fellow who registers in advance will receive a card listing the entertain-

ment activities which he must check if he is interested and return the card accompanied by personal check to cover the total amount to Mrs. Verne C. Hunt, Box 95, San Marino, California.

#### ADVANCE REGISTRATION

Surgeons who wish to attend the Congress should register in advance. Under a new plan advance registration will greatly expedite the procedure of registering.

No registration fee will be charged. Fellows whose dues are paid to December 31, 1947, for endorsed Juniors and Senior Candidates, the fee will be \$5.00. Non-Fellows who after individual consideration are permitted to register, will pay a fee of \$10.00.

No registration fee will be required of initiates of the class of 1948.

#### HOTEL RESERVATIONS

It is desirable to make hotel reservations as early as possible because of the shortage of hotel rooms that prevails in Los Angeles as well as in other cities. In making these communications should be addressed to the Los Angeles Convention and Visitors Bureau, care of the Los Angeles Chamber of Commerce, stating that you will be attending the Clinical Congress of the American College of Surgeons. All hotel reservations for the Clinical Congress are to clear through this Bureau. No correspondence should be sent directly to the hotels. A form for reservations was enclosed in the letter recently sent to Fellows. Choice of hotels may be designated. The hotels in Los Angeles require a deposit in advance.

### CLINICAL CONGRESS PROGRAM IN BRIEF

#### Monday, October 18

- 8:00-12:00 Clinics and Demonstrations—Local Hospitals
- 9:00-12:30 General Assembly—Ballroom
- 1:30-3:30 Panel Discussion—Philharmonic Auditorium
- 3:00-4:00 Television Surgical Specialties—Foyer Biltmore Bowl (Lower Level)
- 2:00-5:00 Clinics and Demonstrations—Local Hospitals
- 2:00-5:00 Hospital Conference—Ballroom
- 3:30-5:30 Panel Discussion—Philharmonic Auditorium
- 8:15-10:30 Presidential Meeting—Philharmonic Auditorium

#### Tuesday, October 19

- 8:00-1:00 Clinics and Demonstrations—Local Hospital
- 8:30-12:00 Forum on Fundamental Surgical Problems—Philharmonic Auditorium
- 8:10-12:00 Forum on Fundamental Surgical Problems—Ballroom
- 9:00-10:30 Panel Discussion Ophthalmology—Conference Room No. 1

- 9:30-12:30 Surgical Film Exhibition (General)—Biltmore Theater
- 10:00-12:30 Hospital Conference—Music Room
- 10:00-12:00 Television General Surgery—Foyer Biltmore Bowl
- 10:45-12:15 Panel Discussion—Otolaryngology—Conference Room No. 1
- 1:30-3:00 Panel Discussion—Philharmonic Auditorium
- 3:00-5:30 Clinics and Demonstrations—Local Hospitals
- 2:00-4:00 Television Surgical Specialties—Foyer Biltmore Bowl
- 2:00-4:00 Surgical Film Exhibition (E.E.N.T.)—Conference Room No. 1
- 2:00-5:00 Hospital Standardization Conference—Music Room
- 2:00-5:00 Symposium Cancer Is Curable—Ballroom
- 2:00-5:00 Symposium on Fractures and other Traumas—Biltmore Theater
- 3:30-5:00 Panel Discussion—Philharmonic Auditorium

- 7:00-8:00 Surgical Film Exhibition (E.E.N.T.)—Conference Room No. 3  
 8:00-9:00 Hospital Conference—Music Room  
 8:00-9:00 Scientific Session—General Surgery—Philharmonic Auditorium  
 8:00-9:00 Scientific Session—Ophthalmology—Conference Room No. 2  
 8:00-9:00 Scientific Session—Otorhinolaryngology—Conference Room No. 2

#### Wednesday October 20

- 7:45-9:45 Breakfast Conference—Press and Radio Representatives and Hospital Personnel—Conference Room No. 6  
 8:00-9:00 Meeting of Cancer Committee—Conference Room No. 6  
 8:00-9:00 Clinics and Demonstrations—Local Hospitals  
 8:30-9:00 Forum on Fundamental Surgical Problems—Ballroom  
 8:30-9:00 Forum on Fundamental Surgical Problems—Philharmonic Auditorium  
 9:00-9:00 Panel Discussion—Ophthalmology—Conference Room No. 2  
 9:00-9:00 State and Provincial Executive Committees—West Gold Room, Ambassador Hotel  
 9:30-9:00 Surgical Film Exhibition (General)—Biltmore Theater  
 9:00-9:00 Hospital Conference—Music Room  
 9:00-9:00 Television, General Surgery—Foyer Biltmore Bowl (Lower Level)  
 9:00-9:00 Stat and Provincial Credentials Committees and Committees on Applicants and Judiciary Committees—West Gold Room, Ambassador Hotel  
 9:45-9:00 5 Panel Discussion—Otorhinolaryngology—Conference Room No. 2  
 9:00-9:00 Luncheon—Meeting of Board of Governors—West Gold Room, Ambassador Hotel  
 9:30-9:00 Panel Discussion—Philharmonic Auditorium  
 9:30-9:00 Clinics and Demonstrations—Local Hospitals  
 9:00-9:00 Surgical Film Exhibition (E.E.N.T.)—Conference Room No. 2  
 9:00-9:00 Television—Surgical Specialties—Foyer Biltmore Bowl (Lower Level)  
 9:00-9:00 Symposium on Cancer—Ballroom  
 9:00-9:00 Hospital Conference—Music Room  
 9:30-9:00 Panel Discussion—Philharmonic Auditorium  
 9:30-9:00 Meeting of National and Regional Fracture Committees—Conference Room No. 2  
 9:00-9:00 Surgical Film Exhibition (E.E.N.T.)—Conference Room No. 2  
 8:00-9:00 Combined Session—Ophthalmology and Otorhinolaryngology—Conference Room No. 2  
 8:00-9:00 Scientific Session—General Surgery—Philharmonic Auditorium  
 8:00-9:00 Hospital Conference—Music Room

#### Thursday October 21

- 8:00-9:00 Clinics and Demonstrations—Local Hospitals  
 8:30-9:00 Forum on Fundamental Surgical Problems—Ballroom  
 8:30-9:00 Forum on Fundamental Surgical Problems—Philharmonic Auditorium  
 9:00-9:00 Panel Discussion—Ophthalmology—Conference Room No. 2

- 9:00-12:00 Surgical Film Exhibition (General)—Biltmore Theater  
 9:00-9:00 Hospital Conference—Music Room  
 9:00-9:00 Television, General Surgery—Foyer Biltmore Bowl  
 9:45-9:00 Panel Discussion—Otorhinolaryngology—Conference Room No. 2  
 9:30-9:00 Adjourned Meeting, Governors—Ballroom  
 9:45-9:00 Annual Meeting, Fracture—Ballroom  
 9:00-9:00 Television, Surgical Specialties—Foyer Biltmore Bowl  
 9:00-9:00 Clinics and Demonstrations—Local Hospitals  
 9:00-9:00 Hospital Conference—Music Room  
 9:30-9:00 Surgical Film Exhibition (General)—Biltmore Theater  
 9:00-9:00 Committee on The Library—Conference Room No. 6  
 9:00-9:00 Symposium, Graduate Training in Surgery—Ballroom  
 9:30-9:00 Panel Discussion—Philharmonic Auditorium  
 9:00-9:00 Dinner for Committee on Fractures and Other Traumas and Chairmen, Regional Committees—Engineers' Club  
 9:00-9:00 Surgical Film Exhibition (E.E.N.T.)—Conference Room No. 2  
 8:00-9:00 Hospital Conference—Music Room  
 8:00-9:00 Scientific Session—General Surgery—Philharmonic Auditorium  
 8:00-9:00 Scientific Session—Ophthalmology—Conference Room No. 2  
 8:00-9:00 Scientific Session—Otorhinolaryngology—Conference Room No. 2

#### Friday October 22

- 8:00-9:00 Clinics and Demonstrations—Local Hospitals  
 8:30-9:00 Forum on Fundamental Surgical Problems—Ballroom  
 8:30-9:00 Forum on Fundamental Surgical Problems—Philharmonic Auditorium  
 9:00-9:00 Surgical Film Exhibition (E.E.N.T.)—Biltmore Theater  
 9:30-9:00 Hospital Conference—Visits to Hospitals  
 9:00-9:00 Television, General Surgery—Foyer Biltmore Bowl  
 9:30-9:00 Surgical Film Exhibition (General)—Biltmore Theater  
 9:30-9:00 Assembly of Initiates—Temple Baptist Church  
 9:30-9:00 Hospital Conference—Ballroom  
 9:30-9:00 Panel Discussions for each of the following: Gynecology and Obstetrics—Conference Room No. 2  
 Plastic Surgery—Conference Room No. 2  
 Neurological Surgery—Ballroom  
 Thoracic Surgery—Burdett Hall, Temple Baptist Church  
 Urology—Auditorium, Southern California Edison Building  
 Orthopedic Surgery—Biltmore Theater  
 9:00-9:00 Television, Surgical Specialties—Foyer Biltmore Bowl  
 9:00-9:00 Clinics and Demonstrations—Local Hospitals  
 9:30-9:00 Assembly of Initiates for Processional—Temple Baptist Church  
 8:30-9:00 Convocation—Philharmonic Auditorium

## GENERAL ASSEMBLY

### JOINT SESSION—SURGEONS AND HOSPITAL REPRESENTATIVES

*Monday 10 00 a m.—12 30 p m.—Ballroom—Biltmore Hotel*

- ARTHUR W ALLEN M D F A C S, Boston President, American College of Surgeons Presiding  
Address of Welcome from the City of Los Angeles HONORABLE FLETCHER BOWRON Los Angeles Mayor of  
City of Los Angeles  
Greetings from the Association of Western Hospitals HORACE TURNER, Spokane President  
Looking Forward With Hospital Standardization ARTHUR W ALLEN M D., Boston  
Activities of the American College of Surgeons—A Dynamic Program IRVIN ABELL, M D F A C S  
Louisville Chairman Board of Regents.  
Preservation of the Voluntary Hospital System REV JOHN J FLANAGAN S J St Louis Executive Direc  
tor Catholic Hospital Association.  
The Hospital of Tomorrow JAMES A. HAMILTON Minneapolis Professor and Director Course in Hospital  
Administration University of Minnesota Hospital Consultant  
The Value of Motion Pictures in Medical Education CHARLES B PUESTOW M D M Sc. Ph D F A C S  
Chicago Professor of Surgery and Assistant Dean in Charge of Education in Surgery University of  
Illinois College of Medicine and Illinois Post Graduate Medical School Chief Surgical Consultant  
Veterans Administration Hospital Hines Chairman Committee on Medical Motion Pictures American  
College of Surgeons.  
Premiere Showing An Introduction to FRACTURES Film Directed by Harrison L. McLaughlin M D  
New York Assistant Professor of Clinical Orthopedic Surgery Columbia University College of Physi  
cians and Surgeons.  
(Sponsored by the American College of Surgeons and Committee on Fractures and Other Traumas and  
made possible through a grant from the Johnson & Johnson Research Foundation)  
Introduced by ROBERT H KENNEDY M D F A C S New York Clinical Professor of Surgery  
New York University College of Medicine Post Graduate Division Chairman Committee on Frac  
tures and Other Traumas, American College of Surgeons

## EVENING SCIENTIFIC SESSIONS

### GENERAL SURGERY

*Tuesday 8 00—10.30 p m*

#### *Symposium on Malignant Lesions of the Thyroid Gland*

- Histologic Types of Thyroid Carcinoma and Their Clinical Significance FRANK W FOOTE M D New York  
Aberrant Thyroid BRIEN T KING, M D F A C S Seattle  
Malignancy in Nodular Goiter WARREN H. COLE, M D F A C S Chicago  
Radioactive Iodine for the Treatment of Thyroid Disease Including Carcinoma. MYRON PRINZMETAL  
M D Los Angeles

*Wednesday 8 00—10 30 p m*

- Fracture Oration Colles Fracture HENRY C. MARBLE M D F A C S Boston

#### *Symposium on Endometriosis*

- Etiology of Endometriosis BROOKS RANNEY M D Chicago  
Surgical Procedures Involved in the Treatment of Endometriosis VIRGIL S COUNSELLER M D F A C S  
Rochester Minnesota.  
The Medical Treatment and Significance of Endometriosis. JOE V MEIGS M D F A C S Boston

*Thursday 8 00—10.30 p m*

#### *Symposium on Surgery of the Heart and Great Vessels*

- Surgical Treatment of Pulmonic Stenosis. ALFRED BLALOCK M D F A C S Baltimore  
The Surgical Treatment of Constrictive Pericarditis EMILE F HOLMAN M D F A C S San Francisco  
The Surgery of Patent Ductus Arteriosus. JOHN C JONES, M D F A C S Los Angeles.  
Treatment of Coarctation of the Aorta ROBERT E. CROSS M D F A C S Boston

## OPHTHALMOLOGY

Tuesday 8:00-10:30 p.m.

Tumors of the Eyelids and the Conjunctiva. MICHAEL J. HOGAN, M.D., San Francisco.  
 Partial Keratectomy. GEORGE L. KILGORE, M.D., San Francisco.  
 Diathermy Cauterization of the Ciliary Body for Glaucoma. SAMUEL J. MEYER, M.D., F.A.C.S., Chicago.

Thursday 8:00-10:30 p.m.

The Use of Retrobulbar Alcohol Injection for Ocular Pain. ALFRED E. MAUMENY, M.D., Baltimore.  
 The Differential Diagnosis of Retinal Detachment and its Operative Treatment. DOUGLASS K. PUGH, M.D., San Francisco.  
 Correlation of the Anatomic Factors Concerned in the Ophthalmoscopic Appearance of Retinal Hemorrhages. HOMER F. SMITH, M.D., Salt Lake City.

## OTORHINOLARYNGOLOGY

Tuesday 8:00-10:30 p.m.

Effect of Streptomycin on Eighth Nerve Function. PAGE NORTHINGTON, M.D., F.A.C.S., Oakland.  
 Anatomical Considerations in Ear Surgery. J. BROWN FARRIOR, M.D., F.A.C.S., Tampa.  
 Chronic Laryngeal Stenosis. JOHN B. ERICH, M.D., F.A.C.S., Rochester, Minnesota.

Thursday 8:00-10:30 p.m.

Present Day Status of Frenotomy Surgery. LEIGHTON F. JOHNSON, M.D., F.A.C.S., Boston.  
 Tumors of the Nasopharynx. HARRY C. ROSENBERGER, M.D., F.A.C.S., Cleveland.  
 The Modern Management of Oro-Antral Fistula. RICHARD THOMAS BARTON, M.D., Beverly Hills.  
 Surgical Treatment of Laryngeal Cancer. CHEVALIER L. JACKSON, M.D., F.A.C.S., Philadelphia.

## COMBINED SESSION—OPHTHALMOLOGY—OTORHINOLARYNGOLOGY

## PANEL DISCUSSION

Wednesday 8:00-10:30 p.m.

Neoplasms of the Eyelids, Orbit, Nose and Accessory Sinuses: Treatment and Plastic Repair.  
 Moderator: GORDON B. NEW, M.D., F.A.C.S., Rochester, Minnesota.  
 Collaborators: AUBREY G. RAWLINS, M.D., San Francisco; EDMUND B. SPARTIL, M.D., F.A.C.S., Philadelphia; JOHN B. ERICH, M.D., F.A.C.S., Rochester, Minnesota; MICHAEL J. HOGAN, M.D., San Francisco.

## PANEL DISCUSSIONS

## GENERAL SURGERY

Monday 1:30-3:00 p.m.

Acute Renal Failure in Surgical Patients.  
 Moderator: FREDERICK A. COLLIER, M.D., F.A.C.S., Ann Arbor.  
 Collaborators: CHARLES D. CREVIER, M.D., Minneapolis; ERNEST E. MUTHHEAD, M.D., Dallas; WILLIAM O. RUSSELL, M.D., Santa Barbara.

Monday 3:30-5:00 p.m.

Tumors of the Middle Jaw and Face.  
 Moderator: GORDON B. NEW, M.D., F.A.C.S., Rochester, Minnesota.  
 Collaborators: LOUIS T. BLAIR, M.D., F.A.C.S., St. Louis; J. ELLIOTT SCARBOROUGH, JR., M.D., F.A.C.S., Atlanta; ERNEST M. DALAND, M.D., F.A.C.S., Boston.

Tuesday 1:30-3:00 p.m.

Low Living Malignant Lesions of the Bowel.  
 Moderator: FRED W. RANKIN, M.D., F.A.C.S., Lexington.  
 Collaborators: R. KENNEDY GILCHRIST, M.D., F.A.C.S., Chicago; THOMAS E. JONES, M.D., F.A.C.S., Cleveland; JESSIE GRAY, M.D., Toronto.

Tuesday 3 30-5 00 p m.

*Evaluation of Liver Function in Relation to Surgery*

Moderator NATHAN A WOMACK M.D. F.A.C.S. Iowa City

Collaborators EVERETT L EVANS M.D. F.A.C.S., Richmond ARTHUR H. BLAKEMORE, M.D. New York  
JESSE L. BOLLMAN M.D., Rochester Minnesota

Wednesday 1 30-3.00 p m

*Peripheral Arterial Disease*

Moderator ALTON OCHSNER M.D. F.A.C.S. New Orleans.

Collaborators NORMAN E FREEMAN M.D. F.A.C.S. San Francisco I RIDGEWAY TRIMBLE, M.D.  
Baltimore ROBERT R. LINTON M.D. F.A.C.S. Boston

Wednesday 3.30-5 00 p m.

*Ulcerative Colitis*

Moderator HENRY W CAVE, M.D. F.A.C.S. New York.

Collaborators ALBERT J SULLIVAN M.D. New Orleans CLARENCE DENNIS, M.D. Minneapolis  
CLAUDE F DIXON M.D. F.A.C.S. Rochester Minnesota.

Thursday 3.30-5 00 p m

*Isotopes in Surgery*

Moderator GEORGE M CURTIS M.D. F.A.C.S. Columbus

Collaborators EARL R MILLER, M.D. San Francisco JOSEPH G HAMILTON M.D. Berkeley OLIVER  
COPE, M.D. F.A.C.S. Boston BEVERLY C. SMITH M.D. F.A.C.S. New York.

## SURGICAL SPECIALTIES, Friday, 1 30-4 55 p m

## UROLOGY

Moderator REED M VESBIT, M.D. F.A.C.S. Ann Arbor

*Present Day Management of Urinary Tract Infections*Collaborators GRAYSON CARROLL, M.D. F.A.C.S. St Louis WILLOUGHBY E KITTREDGE M.D.  
F.A.C.S. New Orleans GILBERT J THOMAS M.D. F.A.C.S. Beverly Hills*The Clinical Management of Branched Renal Calculi*Collaborators JAMES T PRIESTLY M.D. F.A.C.S. Rochester Minnesota RUBIN H. FLOCKS, M.D.  
F.A.C.S. Iowa City THOMAS E GIBSON M.D. F.A.C.S. San Francisco

## ORTHOPEDIC SURGERY

Moderator JOHN C. WILSON M.D. F.A.C.S. Los Angeles

*Mechanical Derangements of the Knee Joint*Collaborators DOUGLAS D TOFFELMIER, M.D. Oakland FRANCIS J COX M.D. San Francisco  
FRANCIS E. WEST M.D., San Diego*Fractures About the Hip*Collaborators J SIMS NORMAN M.D. F.A.C.S. Pueblo JOHN J LOUTIENHEISER, M.D. San Fran-  
cisco JAMES K. STACK M.D. F.A.C.S. Chicago

## NEUROLOGICAL SURGERY

Moderator HOWARD C NAFFZIGER M.D., F.A.C.S. San Francisco

*Cerebral Angiography*Collaborators CARL F LIST M.D. F.A.C.S. Grand Rapids EDWIN B BOLDREY M.D. F.A.C.S.,  
San Francisco EARL R MILLER M.D. San Francisco WALLACE B HAMBY M.D. F.A.C.S.  
Buffalo JAMES L POPPEN M.D. F.A.C.S. Boston

## GYNECOLOGY AND OBSTETRICS

Moderator JOHN C BURCH M.D. F.A.C.S. Nashville

*Hysterectomy Physiological Considerations—Indications*Collaborators LANGDON PARSONS M.D. F.A.C.S. Boston CONRAD G COLLINS M.D. F.A.C.S.  
New Orleans R. GLENN CRAIG M.D., F.A.C.S. San Francisco KARL H MARTELLOFF M.D.  
F.A.C.S. Portland*Hysterectomy Technical Considerations—Complications*

Collaborators (Same as above)

## THORACIC SURGERY

Moderator FRANK S. DOLLEY, M.D., F.A.C.S., Los Angeles.

*Diagnosis and Surgical Treatment by Pulmonary Resection for Carcinoma, Bronchiectasis and Tuberculosis*  
 Collaborators: EVARTS A. GRAHAM, M.D., F.A.C.S., St. Louis; FRANK B. BERRY, M.D., F.A.C.S., New York; HERBERT C. MAIER, M.D., F.A.C.S., New York.

*Surgery of the Esophagus*

Collaborators: RALPH H. ADAMS, M.D., F.A.C.S., Louisville; LYMAN A. BREWER, III, M.D., F.A.C.S., Los Angeles; JOHN W. STRIEDER, M.D., Boston.

## PLASTIC SURGERY

Moderator: TRUMAN G. BLOCKER, JR., M.D., F.A.C.S., Galveston.

*Congenital Facial Deformities*

Collaborators: DOUGLAS W. MACOMBER, M.D., F.A.C.S., Denver; WILLIAM S. KISKADDEN, M.D., F.A.C.S., Los Angeles; THOMAS D. CHRONIN, M.D., F.A.C.S., Houston; WALLACE H. STEFFENSEN, M.D., F.A.C.S., Grand Rapids.

*Burn Contractures of the Extremities*

Collaborators: GEORGE V. WEBSTER, M.D., F.A.C.S., Pasadena; GERALD B. O'CONNOR, M.D., F.A.C.S., San Francisco; LOUIS T. BYARS, M.D., F.A.C.S., St. Louis; NATHANIEL B. SOOBERBERG, M.D., F.A.C.S., Phoenixville, Pennsylvania.

## OPHTHALMOLOGY

Tuesday 9.00-10.30 a.m.

*Surgical Management of Glaucoma*

Moderator: A. RAY IRVING, M.D., F.A.C.S., Los Angeles.

Collaborators: CLAUDE S. MUMMA, M.D., F.A.C.S., Los Angeles; ROBERT N. SHAFER, M.D., San Francisco; J. HEWITT JUDD, M.D., Omaha.

Wednesday 9.00-10.30 a.m.

*Congenital Cataract*

Moderator: OTTO BARKAN, M.D., San Francisco.

Collaborators: S. RODMAN IRVING, M.D., F.A.C.S., Los Angeles; HAROLD F. WHEALMAN, M.D., Los Angeles; RAYMOND J. NUTTING, M.D., Oakland.

Thursday 9.00-10.30 a.m.

*Surgery of the Oblique Muscles*

Moderator: C. ALLEN DICKEY, M.D., San Francisco.

Collaborators: ORWYN H. ELLIS, M.D., F.A.C.S., Los Angeles; AVERY MORLEY HICKS, M.D., San Francisco; ALFRED R. ROBBINS, M.D., Los Angeles.

## OTORHINOLARYNGOLOGY

Tuesday 10.45 a.m.-12.5 p.m.

*Rehabilitation of the Hard of Hearing*

Moderator: WALTER P. WORM, M.D., San Francisco.

Collaborators: HOWARD P. HOUSE, M.D., F.A.C.S., Los Angeles; S. RICHARD SILVERMAN, M.D., St. Louis; HAROLD M. E. BOYD, M.D., Los Angeles.

Wednesday 10.45 a.m.-12.15 p.m.

*The Preparation of the Surgical Patient and Post-Operative Care*

Moderator: COLBY HALL, M.D., Los Angeles.

Collaborators: VICTOR GOODHILL, M.D., F.A.C.S., Los Angeles; CHARLES F. MCCURKEY, M.D., Los Angeles; HAROLD OWENS, M.D., Los Angeles.

Thursday 10.45 a.m.-12.15 p.m.

*Diseases of the Esophagus*

Moderator: ALDEN H. MILLER, M.D., Los Angeles.

Collaborators: SIMON JENSEN, M.D., Los Angeles; LEWIS F. MORRISON, M.D., San Francisco; AMBROSE S. CHURCHILL, M.D., Los Angeles.

# SYMPOSIUM ON FRACTURES AND OTHER TRAUMAS

Tuesday 2:00-5:00 p.m.

ROBERT H. KENNEDY M.D. F.A.C.S. New York Chairman Committee on Fractures and Other Traumas  
 Presiding

Avulsions of the Skin CARLETON MATHEWSON JR. M.D. F.A.C.S. San Francisco Professor of Surgery  
 Stanford University School of Medicine  
 Secondary Closure of Wounds HARRY C. BLAIR, M.D. F.A.C.S. Portland Associate Clinical Professor  
 of Orthopedics, University of Oregon Medical School  
 Care of Acute Amputations of the Fingers WALTER C. GRAHAM M.D. F.A.C.S. Santa Barbara Attending  
 Orthopedic Surgeon Santa Barbara Cottage and Santa Barbara General Hospitals  
 Fractures of the Lower End of the Humerus in Children JOHN C. WILSON M.D. F.A.C.S. Los Angeles  
 Clinical Professor of Orthopedic Surgery University of Southern California School of Medicine Chief  
 Orthopedic Staff Children's Hospital  
 Wounds of the Heart R. ARNOLD GRISWOLD M.D. F.A.C.S. Louisville Professor and Head Department  
 of Surgery University of Louisville School of Medicine  
 Acute Arterial Emergencies JERE W. LORD JR. M.D. F.A.C.S. New York Instructor in Surgery Cornell  
 University Medical College  
 Evaluation of Principles Concerned in Management of Trauma to the Kidney LAZARUS A. ORKIN M.D.  
 F.A.C.S. New York Chief of Clinic and Adjunct in Urology Beckman Downtown Hospital.

# SYMPOSIUM CANCER IS CURABLE

Tuesday 2:00-5:00 p.m.

GRANTLEY W. TAYLOR M.D. F.A.C.S. Boston Chairman Cancer Committee American College of  
 Surgeons, Presiding

Value of Statistics in the Curability of Cancer BOWMAN C. CROWELL M.D. Chicago Associate Director  
 American College of Surgeons and Director of the Department of Clinical Research  
 Variables in Attainment of High Rates of Cancer Cures FREDERICK S. WETHERELL, M.D. F.A.C.S.  
 Syracuse Senior Attending Surgeon Syracuse Memorial Hospital Chairman Service and Medical  
 Advisory Committee New York State Division American Cancer Society  
 The Curability of Cancer in Children SIDNEY FARBER M.D. Boston Professor of Pathology Harvard  
 Medical School Director Division of Laboratories and Research The Children's Medical Center  
 Boston  
 Encouraging Excerpts from Recorded Cancer Experience FRED J. HODGES M.D. Ann Arbor Professor of  
 Roentgenology University of Michigan Chairman Department of Roentgenology University Hospital  
 Present Trends and Five Year Results of Cancer Therapy at Memorial Hospital in New York City FRANK E.  
 ADAIR M.D., F.A.C.S. New York Associate Professor of Clinical Surgery Cornell University Medical  
 College Attending Surgeon Memorial Hospital for Cancer and Allied Diseases  
 Cures of Cancer at the Massachusetts General Hospital GRANTLEY W. TAYLOR M.D. F.A.C.S. Boston  
 Associate in Surgery Harvard Medical School Chairman Cancer Committee American College of  
 Surgeons  
 Five Year Cures in a University Hospital J. ELLIOTT SCARBOROUGH M.D. F.A.C.S. Atlanta Associate in  
 Surgery Emory University School of Medicine Attending Surgeon and Director of Tumor Clinic  
 Emory University Hospital  
 Five Year Cures in Bronchogenic Carcinoma from the Chest Service of the Barnes Hospital EVARTS A.  
 GRAHAM M.D. F.A.C.S. St. Louis Professor of Surgery Washington University School of Medicine  
 Surgeon-in-Chief Barnes Hospital  
 Five Year Cures in Carcinoma of the Large Intestine GEORGE V. BRINDLEY M.D. F.A.C.S. Temple  
 Texas Lecturer in Surgery University of Texas Medical School Chief Surgeon Scott and White  
 Clinic and R. R. WITZ, M.D. Temple Surgeon Scott and White Clinic  
 Cancer of the Colon and Rectum with Particular Reference to the Results of Surgical Treatment CLAUDE  
 F. DIXON M.D., F.A.C.S. Rochester Professor of Surgery Mayo Foundation and Surgeon Mayo  
 Clinic and R. LEE CLARK, JR., M.D. F.A.C.S. Houston Director and Surgeon in Chief The Univer  
 sity of Texas M. D. Anderson Hospital for Cancer Research  
 Experiences with the Curability of Cancer in Connecticut EDWARD J. OTTENHEIMER M.D. F.A.C.S.  
 Willamantic Chief Surgical Service Windham Community Memorial Hospital  
 Five Year Results of Treatment Ellis Fischel State Cancer Hospital  
 Missouri Chief Surgeon Ellis Fischel State Cancer Hospital  
 Cancer Cures in a Veterans Administration Hospital CHARLES B. PUESTOW M.D. F.A.C.S. Chicago  
 Professor of Surgery University of Illinois College of Medicine Chief Surgical Service Veterans  
 Administration Hospital Hines.



Report of Five Year Cures of Cancer from Private Practice and from King County Hospital. DONALD A. TRUMBULL, M.D., F.A.C.S., Seattle. Chief, Department of Surgery, Doctors Hospital, Director Neoplastic Clinic, King County Hospital.

## SYMPOSIUM ON CANCER

*Wednesday 2:00-5:00 p.m.*

GRANTLEY W. TAYLOR, M.D., F.A.C.S., Boston, Chairman, Cancer Committee, American College of Surgeons, presiding.  
 Tumors of the Central Nervous System. EDWIN H. B. BERRY, M.D., F.A.C.S., San Francisco, assistant clinical professor of surgery, University of California Medical School.  
 Cancer of the Stomach. A Survey of 1004 Cases. STANLEY I. LAWY, M.D., F.A.C.S., Chicago, assistant professor of surgery, University of Illinois (Rush) College of Medicine.  
 Lymphoma. SIDNEY FARRER, M.D., Boston, professor of pathology, Harvard Medical School.  
 Early Diagnosis of Prostate Treatment of Cancer of Urinary Bladder. CLYDE J. THOMAS, M.D., F.A.C.S., Beverly Hills, associate clinical professor of surgery (urology), University of Southern California School of Medicine.  
 Tumors of the Pancreas. DAVID P. SLAUGHTER, M.D., F.A.C.S., Chicago, assistant professor of surgery, University of Illinois College of Medicine.  
 Cancer of the Ovary. JOE A. MEIGS, M.D., F.A.C.S., Boston, clinical professor of gynecology, Harvard University Medical School.

## SYMPOSIUM ON GRADUATE TRAINING IN SURGERY AND THE SURGICAL SPECIALTIES

*Thursday 3:00-6:00 p.m.*

FREDERICK A. CHLIFER, M.D., F.A.C.S., Chairman, Committee on Graduate Training in Surgery, Presiding. Progress in Graduate Training.  
 FREDERICK A. CHLIFER, M.D.  
 The Inclusion of Residents in the Resources for Graduate Training in Surgery. THOMAS H. SWIFT, M.D., F.A.C.S., Minneapolis, Clinical Assistant Professor of Surgery, Division of Urology, University of Minnesota.  
 The Graduate Training Requirement for Specialization. Thoracic Surgery. WILLIAM E. ADAMS, M.D., F.A.C.S., Chicago, Professor of Surgery, University of Chicago, The School of Medicine of the Division of Biological Sciences.  
 Essentials of Orthopedic Graduate Training and Acceptable Alternatives in Training. LEROY C. ABBOTT, M.D., F.A.C.S., San Francisco, Professor of Orthopedic Surgery, University of California School of Medicine, Chief, Orthopedic Service, Children's Hospital.  
 Essentials and Proposed Changes in Graduate Training Requirement for Specialization in Urology. CLYDE J. THOMAS, M.D., F.A.C.S., Beverly Hills, Clinical Associate Professor of Surgery (Urology), University of Southern California School of Medicine.

## PRESIDENTIAL MEETING

*Monday 8:15-10:30 p.m. - The Philharmonic Auditorium*

ARTHUR W. ALLEN, M.D., F.A.C.S., Boston, President, American College of Surgeons, Presiding.  
 Professional—Officers, Regents and Distinguished Guests.  
 Vocational.

The Most Reverend J. FRANCIS A. MCINTYRE, Los Angeles, Archbishop, Archdiocese of Los Angeles.  
 Address of Welcome.  
 DONALD G. TOLLEPSON, M.D., F.A.C.S., Los Angeles.  
 Chairman, Committee on Arrangements.  
 Introduction of Distinguished Guest.  
 IRVING ABELL, M.D., F.A.C.S., Louisville.  
 Chairman, Board of Regents.  
 Address of the Retiring President, Looking Forward.  
 ARTHUR W. ALLEN, M.D.  
 Inauguration of Officers:  
 Presented by THOMAS F. JONES, M.D., F.A.C.S., Cleveland;  
 Retiring First Vice President.

# CLINICAL CONGRESS 1948

First Vice President HOWARD A. PATTERSON M.D. F.A.C.S. New York  
 Second Vice President CARL H. McCASKEY M.D., F.A.C.S. Indianapolis  
 President DALLAS B. PHEMISTER M.D. F.A.C.S. Chicago  
 The Third Martin Memorial Lecture Some Aspects of the Development of Intrathoracic Surgery  
 CLARENCE CRAWFORD M.D. Stockholm Sweden Professor of Surgery Karolinska Mediko-Kirurgiska  
 Institutet

## CONVOCATION

Friday 8 15-10.30 p.m. — *The Philharmonic Auditorium*

DALLAS B. PHEMISTER M.D. F.A.C.S. Chicago President, American College of Surgeons Presiding  
 Processional—Initiates Officers Regents and Distinguished Guests  
 Invocation

The Right Reverend Francis Eric Bloy Los Angeles Bishop Diocese of Los Angeles  
 Presentation of Initiates for Fellowship  
 IRVIN ABELL, M.D. F.A.C.S. Louisville  
 Chairman Board of Regents

Fellowship Pledge Recital by Initiates  
 Conferring of Fellowships by the President  
 DALLAS B. PHEMISTER, M.D.

Conferring of Honorary Fellowships  
 The President

Fellowship Address Hereditary Errors in Metabolism  
 GEORGE W. BEADLE, Ph.D., Pasadena California  
 Professor and Chairman Department of Biology California Institute of Technology

Recessional

Reception by the Officers and Regents for the Initiates and Fellows

## ANNUAL MEETING BOARD OF GOVERNORS OF THE COLLEGE

Wednesday 12 15 p.m. — 2.00 p.m. — *West Gold Room Ambassador Hotel*

DALLAS B. PHEMISTER, M.D. F.A.C.S., Chicago President American College of Surgeons Presiding  
 Statement by the Chairman of the Board of Regents  
 IRVIN ABELL, M.D. F.A.C.S. Louisville  
 Brief Reports on the Activities Problems and Progress of the American College of Surgeons  
 ARTHUR W. ALLEN M.D. F.A.C.S., Boston Immediate Past President  
 FREDERICK A. COLLIER M.D. F.A.C.S. Ann Arbor Regent  
 Discussion by Governors and Regents

## ADJOURNED MEETING BOARD OF GOVERNORS OF THE COLLEGE

Thursday 1 30 p.m. — *Ballroom The Biltmore Hotel*

DALLAS B. PHEMISTER M.D. F.A.C.S. Chicago President American College of Surgeons, Presiding  
 Report of Committee on Nominations to the Board of Governors  
 Election of Regents of the College

## ANNUAL MEETING, FELLOWS OF THE COLLEGE

Thursday 1 45-3.00 p.m. — *Ballroom The Biltmore Hotel*

DALLAS B. PHEMISTER M.D. F.A.C.S. Chicago President American College of Surgeons Presiding  
 Report of Committee on Nominations  
 Election of Officers and Governors of the College  
 Report of the Treasurer  
 DALLAS B. PHEMISTER, M.D., Chicago Treasurer  
 EDWARD G. SANDROK Comptroller  
 Cancer Committee  
 CRANTLEY W. TAYLOR M.D. F.A.C.S. Boston Chairman



Esophageal Wound Healing An Experimental Study ALFONSO TOPETE M.D., JAMES M. FRITZ M.D. and WILLIAM E. ADAMS M.D. F.A.C.S. Chicago Illinois University of Chicago College of Medicine.  
The Limitations of a Gastric Drainage Operation Upon the Effectiveness of Vagotomy C. WALTON LILLIE, M.D., Minneapolis Minnesota University of Minnesota Medical School  
The Effect of Vagotomy on Intestinal Motility SALMAN FAIX M.D. F.C. MANN M.D. and JOHN H. GRINDLAY M.D. F.A.C.S. Rochester Minnesota Mayo Foundation  
A New Parasympathetic Stimulant—Ethyl 3,3 Dimethylallyl Barbituric Acid Its Effect on Gastric Secretion C. M. BALLEW M.D., R. L. NOBLE, M.D. D. R. WEBSTER, M.D., and J. R. MCCORRISTON M.D. Montreal Quebec McGill University Faculty of Medicine  
The Use of Buffer and Thrombin in the Control of Gastroduodenal Hemorrhage BYRNE M. DALY M.D. Detroit Michigan Wayne University College of Medicine  
The Intraduodenal Spread of Malignant Gastric Lesions CHARLES P. MARVIN M.D. Atlanta Georgia  
A Study to Determine a Method of Estimating the Proportion of the Stomach Removed in Partial Gastrectomy WESTON A. HEINRICH M.D. Evansville Indiana Mayo Foundation

*Thyroid, Thymus Lungs*

8 30 a.m. Tuesday—Ballroom The Billmore Hotel

FREDERICK A. COLLIER M.D. F.A.C.S. Ann Arbor Professor of Surgery University of Michigan Medical School Presiding  
Thyroid Cancer A Problem of Surgery and Pathology JOHN C. MCCLINTOCK M.D., F.A.C.S. and GUSTAVUS H. KLINCK, JR. M.D. Albany New York Albany Medical College.  
An Experimental Study of the Behavior of Residual Thyroid Tissue Following Subtotal Thyroidectomy THOMAS LEDWICH M.D. FLOYD MARCHI, M.D. MAYO SOLEY M.D. EARL MILLER M.D. GEORGE YER, M.D. KENNETH SCOTT Ph.D. and HORACE J. MCCORMICK M.D. F.A.C.S. San Francisco California. University of California Medical School  
The Effect of Iodine on the Rat Thyroid Activated by Cooling ARTHUR J. LESSER, M.D. RICHARD J. WINZLER, Ph.D. and J. B. MICHAELSON M.S. Los Angeles, California University of Southern California School of Medicine  
A Clinicopathologic Study of Tumors of the Thymic Region PHILIP W. SMITH M.D., Ann Arbor Michigan University of Michigan Medical School  
The Diphenylamine Reaction of Human Serum. SUAD NIAZI, M.D. and DAVID STATE, M.D. F.A.C.S. Minneapolis, Minnesota. University of Minnesota Medical School  
Management of Unilateral Total Bronchiectasis by Pneumonectomy BYRON H. EVANS M.D. Ann Arbor Michigan. University of Michigan Medical School  
Prevention of Mediastinal Shift After Pneumonectomy with a Polythene Bag An Experimental Study JOHN H. GRINDLAY M.D. F.A.C.S. J. R. RYDELL, M.D. and O. THERON CLAGETT M.D. F.A.C.S. Rochester Minnesota Mayo Foundation.  
The Anatomical Guide to the Intersegmental Plane. BEATTY HAIG RAMSAY M.D. Cambridge Massachusetts.  
Segmental Resection of the Upper Pulmonary Lobe for Benign Disease A Plea for Conservation of Lung Tissue ALFRED HURWITZ, M.D. Newington Connecticut Veterans Administration Hospital.  
An Evaluation of Oxygen Therapy JAMES B. HAMMOND M.D. RALPH C. RICHARDS M.D. and PHILIP B. PRICE, M.D. F.A.C.S. Salt Lake City Utah University of Utah School of Medicine  
A New Type of Artificial Respiration STANLEY J. SARNOFF M.D. E. HARDENBERGH, and J. L. WHITT TENBERGER, M.D. Boston Massachusetts Harvard School of Public Health  
Experimental Embolism of Selected Portions of the Pulmonary Arterial Bed MASAAKI HARA M.D. and JOHN R. SMITH M.D. St. Louis Missouri. Washington University School of Medicine

*Surgery of the Heart and Great Vessels*

8 30 a.m. Wednesday—Philharmonic Auditorium

ROBERT E. GROSS, M.D. F.A.C.S. Boston Assistant Professor of Surgery Harvard Medical School Presiding  
Treatment of Aortic Aneurysms By Wrapping with a Foreign Body J. KARL POPPE M.D. F.A.C.S. Portland Oregon  
The Control of Hemorrhage From Experimental Wounds of the Coronary Vessels. HOWARD G. REUSER M.D. and HERGER P. JENKINS M.D. F.A.C.S. Chicago Illinois University of Illinois College of Medicine and Woodlawn Hospital  
Resection of Left Auricular Appendage A Prophylaxis in the Treatment of Recurrent Arterial Embolism JOHN L. MADDEN M.D. Brooklyn New York. Long Island College of Medicine and Kings County Hospital.

- Extirpation of the Auricular Appendage in the Dog. WALTER J. BURDETTE, M.D., New Orleans, Louisiana. Louisiana State University School of Medicine.
- Resection and Grafting of the Thoracic Aorta with Minimal Interruption of the Circulation. CHARLES A. HUTNAGEL, M.D. Boston, Massachusetts. Harvard Medical School.
- Studies of Intraradial and Intrafemoral Arterial Pressure and Arterial Pulse Contours Before and After Corrective Surgical Procedures for Coarctation of the Aorta. GEORGE E. BROWN, M.D. Twin Falls, Idaho. O. THERON CLAGETT, M.D. F.A.C.S. H. B. BURCHELL, M.D. and E. H. WOOD, M.D. Rochester, Minnesota. Mayo Foundation.
- Pump Oxygenator to Replace the Heart and Lungs for Brief Periods. CLARENCE DEWITS, M.D. EARL E. KARLSON, M.D., and DARRELL E. WESTOVER, M.D. Minneapolis, Minnesota. University of Minnesota Medical School.
- Establishment of Extra Cardiac Shunts for Treatment of Stenosed Cardiac Valves. ROBERT E. GROSS, M.D. F.A.C.S. E. CONVERSE PERCIE, II, M.D. HAROLD F. RIEHLKANTER, M.D., and ALEXANDER H. BILL, JR., M.D. Boston, Massachusetts. Harvard Medical School and Children's Hospital.
- The Rationale and Technique of Extracorporeal Vascular Shunts. LESTER BLUM, M.D. F.A.C.S. and SAMUEL J. MCGIMON, M.D. New York, New York. Mount Sinai Hospital.
- The Creation and Closure of Artificial Atrial Septal Defects in the Dog. W. B. MARTIN, M.D., H. E. ESKY, Ph.D. H. B. BURCHELL, M.D. and J. EDWARDS, M.D. Rochester, Minnesota. Mayo Foundation.
- The Correction of Aortic Insufficiency in Dogs with an Artificial Aortic Valve. J. MOORE CAMPBELL, M.D. F.A.C.S. Oklahoma City, Oklahoma. University of Oklahoma School of Medicine and University Hospitals.
- Experimental Superior Vena Caval Obstruction. Treatment by Vein to Vein and Auricle to Vein Anastomosis. FRANK GERRODE, M.D. JAMES YEE, M.D. and F. F. RUDDLE, M.D. San Francisco, California. Stanford University School of Medicine.
- Superior Vena Caval Obstruction—A Clinical Study. CHESTER B. NOYES, M.D. San Francisco, California. Stanford University School of Medicine.
- Experimental Lesions of the Pulmonary Artery Associated with Patent Ductus Arteriosus. SANFORD E. LEEDE, M.D. F.A.C.S. San Francisco, California.
- Quantitative Production of Myocardial Necrosis. Experimental Study with a New Method. CARL DAVIS, JR., M.D. C. B. TAYLOR, M.D. and O. H. AAR, M.D. Chicago, Illinois. Presbyterian Hospital and University of Illinois College of Medicine.
- Bones and Joints. Infection. Skin Preparation. Hemostasis. Plastic Surgery.*  
8:30 a.m. Wed. day—Ball room The Biltmore Hotel
- MICHAEL L. MASON, M.D. F.A.C.S. Chicago. Associate Professor of Surgery. Northwestern University Medical School, Preparing.
- The Suction Socket for Above Knee Amputees. PAUL E. McMASTER, M.D. F.A.C.S. and ROBERT MAEST JR., M.D. F.A.C.S. Los Angeles, California. Veterans Administration Hospital.
- Bone Marrow Extirpation of Primary Neoplasms of Bone. J. F. UPHAM, M.D. J. R. MACDONALD, M.D. and R. K. GORMLEY, M.D. F.A.C.S. Rochester, Minnesota. Mayo Foundation.
- The Effect of Intramedullary Pinning on the Healing of Fractures—An Experimental Study. WILLIAM T. FITZ, JR., M.D. BROOKS ROBERTS, M.D. STANLEY I. SPOONT, M.D. and VERN W. RITTER, M.D. Philadelphia, Pennsylvania. University of Pennsylvania School of Medicine and Hospital of the University of Pennsylvania.
- The Anatomy and Physiology of Nerves to Diarthrodial Joints. ERNEST GARDNER, M.D. Detroit, Michigan. Wayne University College of Medicine.
- Streptomycin Therapy of Established Wound Suppuration. MAJOR EDWIN J. PULASKI and LIEUTENANT G. F. CONNELL, JR. M.C. U.S.A. Fort Sam Houston, Texas. Brooke General Hospital.
- The Prophylactic Use of Bacitracin in Experimental Clostridial Infections in Guinea Pigs. WILLIAM R. SANDUSKY, M.D. F.A.C.S. and CONSTANCE F. KEEBLE, B.S. Charlottesville, Virginia. University of Virginia Hospital.
- Clinical Study of the Use of a Synthetic Detergent Combined with a 2,2-Dihydroxy-3,5,6,3',5',6'-Hexachlorodiphenylmethane (G-11) for Disinfection of the Skin. BROOKLYN S. FREEMAN, M.D. F.A.C.S. and THOMAS K. YOUNG, JR., M.D. Temple, Texas. McCloskey Veterans Administration Hospital.
- The Use of Quaternary Ammonium Compound for the Surgical Disinfection of Hands. HENRY SWAN, M.D. RICHARD L. GONZALES, M.D. ALLEN HARRIS, M.D. C. COULSON and M. L. HOPWOOD. Denver, Colorado. University of Colorado School of Medicine.
- A Study of Action of Detergents on Skin by Biological Methods. RICHARD L. THIRLBY, M.D. and A. BURGESS VIAI, M.D. Ann Arbor, Michigan. University of Michigan Medical School.
- Talc Granuloma—A Survey of Its Incidence and Significance. WILLARD B. ROSS, M.D. and JOSEPH M. LURITZ, M.D. Wood Wisconsin. Marquette University School of Medicine and Veterans Administration Hospital.

**Nonreactive Absorbable Glove Powder** RAYMOND W. POSTLETHWAIT, M.D., H. LEE HOWARD, M.D., and PAUL W. SCHANIER, M.D., Durham, North Carolina. Duke University School of Medicine.  
**An Experimental Evaluation of a New Glove Powder for Use in the Operating Room** HOWARD C. NAFF ZIGER, M.D., F.A.C.S., THOMAS LEDWICH, M.D., FLOYD MARCILL, M.D., and HORACE J. MCCORKLE, M.D., F.A.C.S., San Francisco, California. Department of Experimental Surgery, University of California Medical School.

**The Effect of Heparin on Gelfoam Hemostasis** W. J. GROVE, M.D., and C. W. VERMEULEN, M.D., Chicago, Illinois. University of Illinois College of Medicine.

**The Use of Skin Grafts in Cleft Palate Repair to Improve Speech Results** HAMILTON BAXTER, M.D., Montreal, Quebec. McGill University Faculty of Medicine and Royal Victoria Hospital.

**Protein Fluid and Salt Balance Thrombosis and Embolism**

8:30 a.m. Thursday—Philharmonic Auditorium

**ALTON OCHSNER, M.D., F.A.C.S.** New Orleans. William Henderson Professor and Director, Department of Surgery, Tulane University of Louisiana School of Medicine, Presiding.

**The Magnitude of Base Loss in Fecal Fistulae Combined with Continuous Suction Drainage of the Stomach** EVERETT IDRIS EVANS, M.D., F.A.C.S., and K. KELLER VAN SLYKE, M.D., Richmond, Virginia. Medical College of Virginia.

**Abnormal Fluid Distribution in Intractable Postoperative Hypochloremia Further Aggravated by Saline Therapy** RICHARDS P. LYON, M.D., JOSEPH R. STANTON, M.D., F.A.C.S., EDWARD D. FREIS, M.D., and REGINALD H. SMITHWICK, M.D., F.A.C.S., Boston, Massachusetts. Boston University School of Medicine and Massachusetts Memorial Hospitals.

**Response to Parenteral Glucose of Normal Kidneys and of Kidneys of Postoperative Patients** DONALD R. COOPER, M.D., and L. VIVIAN JOB, Ph.D., Ann Arbor, Michigan. University of Michigan Medical School.

**The Influence of Adrenal Cortical Hormone in Hypochloremic Alkalosis** K. KELLER VAN SLYKE, M.D., and EVERETT IDRIS EVANS, M.D., F.A.C.S., Richmond, Virginia. Medical College of Virginia.

**An Experimental Study of Intravenous Alimentation in the Dog** C. MARTIN RHODE, M.D., Philadelphia, Pennsylvania. University of Pennsylvania School of Medicine.

**Massive Hepatic Necrosis in the Protein Depleted Partially Hepatectomized Rat** R. L. ESTRADA, M.D., Z. A. SIMPSON, M.D., and HARRY M. VARR, Ph.D., Philadelphia, Pennsylvania. University of Pennsylvania School of Medicine.

**Human Albumin Nitrogen Balance** DONALD J. FERGUSON, M.D., DAVID STATE, M.D., F.A.C.S., and IVAN D. BARONORSKY, M.D., Minneapolis, Minnesota. University of Minnesota Medical School.

**Some Physiologic Effects of Prolonged Administration of Human Albumin** NICHOLAS S. GIMBEL, M.D., CECILIA RIEGEL, M.D., WILLIAM W. GLENN, M.D., JAMES NIXON, M.D., DOUGLAS W. SANDERS, M.D., and MELVIN SOBEL, M.D., Philadelphia, Pennsylvania. University of Pennsylvania School of Medicine and Hospital of the University of Pennsylvania.

**The Influence of Fat in the Diet Upon Nitrogen Metabolism and Liver Protein Regeneration** HARRY M. VARR, Ph.D., and CHARLES E. FRIEDGOOD, M.D., Philadelphia, Pennsylvania. University of Pennsylvania School of Medicine.

**Measurements of Healing Strength of a Standard Wound in Anemic or Starvation States and After Treatment With Blood Transfusions or Refeeding** YOSHIO SAKO, M.D., ARNOLD KREIEN, M.D., and RICHARD L. VARCO, M.D., Minneapolis, Minnesota. University of Minnesota Medical School.

**Pulmonary Embolism** RICHARD H. LILLIE, M.D., and ROBERT W. BUXTON, M.D., F.A.C.S., Ann Arbor, Michigan. University of Michigan Medical School.

**Experimental Pulmonary Embolism** BYERS W. SHAW, M.D., WILLIAM D. HOLDEN, M.D., F.A.C.S., DONALD B. CAMERON, M.D., PATRICK C. SHEA, JR., M.D., and JOHN H. DAVIS, JR., M.D., Cleveland, Ohio. Western Reserve University School of Medicine and University Hospitals.

**The Effect of Moderate Degrees of Dicumarol Induced Hypoprothrombinemia on Experimental Intravascular Thrombosis** J. FORBES ROGERS, M.D., RAYMOND J. BARRETT, M.D., and CONRAD R. LAM, M.D., F.A.C.S., Detroit, Michigan. Henry Ford Hospital.

**Clinical Studies on the Heparin Cofactor** WILLIAM D. HOLDEN, M.D., F.A.C.S., JOHN H. DAVIS, JR., M.D., and JOHN W. COLE, M.D., Cleveland, Ohio. Western Reserve University School of Medicine.

**Experimental Venous Thrombosis and Its Prevention by Dicumarol** DONALD B. CAMERON, M.D., WILLIAM D. HOLDEN, M.D., F.A.C.S., BYERS W. SHAW, M.D., and PATRICK C. SHEA, JR., M.D., Cleveland, Ohio. Western Reserve University School of Medicine.

**Neurosurgery Radioactive Substances Irradiation**

8:30 a.m. Thursday—Ballroom, The Baltimore Hotel

**CLARENCE E. STAFFORD, M.D., F.A.C.S.** Los Angeles, Acting Head, Department of Surgery, College of Medical Evangelists, Presiding.

- Anhidrosis as Measure of Sympathetic Denervation. GRACE M. ROTH, Ph.D. and WIDCHILL McCRAIG, M.D. F.A.C.S. Rochester, Minnesota. Mayo Foundation.
- Continuous Procaine Paravertebral Sympathetic Blocks. J. R. THOMASON, M.D. and WILLIAM H. MORETZ, M.D. Salt Lake City, Utah. University of Utah School of Medicine and Salt Lake General Hospital.
- A Study of the Action of Sympathomimetic Drugs in Combination with Intrathecal Anesthetic Agents. JOHN C. HENDERSON, M.D., LOUIS L. STOLER, M.D. and I. B. TAYLOR, M.D. Detroit, Michigan. Wayne University College of Medicine and City of Detroit Receiving Hospital.
- The Effects of Position on the Cerebral Circulation of Man. H. A. SHENKIN, M.D., W. G. SCHNEIDERMAN, M.D. and E. B. SUTZ, M.D. Philadelphia, Pennsylvania. University of Pennsylvania School of Medicine and Hospital of the University of Pennsylvania.
- The Role of Nerve Blocks in Restoring the Balance of Traumatic Cord Bladders. ERNEST BORN, M.D., A. L. COMARR, M.D. and S. H. MOULTON, M.D. Van Nuys, California. Birmingham Veterans Administration Hospital.
- Clinical Evaluation of Radiofluorescein as an Aid in the Localization of Brain Tumors. SAMUEL W. HUNTER, M.D., LALE A. FRENCH, M.D. and GEORGE E. MOORE, M.D. Minneapolis, Minnesota. University of Minnesota Medical School.
- Distribution of Trace Doses of Methionine Tagged with Radio Sulfur in Normal and Neoplastic Tissues. ALAN J. KRAMEN, M.D., SAMUEL W. HUNTER, M.D., GEORGE E. MOORE, M.D. and CLAUDE HITCHCOCK, M.D. Minneapolis, Minnesota. University of Minnesota Medical School.
- The Use of Radiocalcium Phosphorus for Diagnostic Study of Lesions of the Breast. HORACE J. MCCORMICK, M.D. F.A.C.S., B. A. LOW BEER, M.D., H. GLENN BELL, M.D. F.A.C.S., and ROBERT STOKES, M.D. San Francisco, California. University of California Medical School.
- Changes in the Clotting Mechanism Associated with Total Body Exposure to Ionizing Irradiation. J. GARRETT ALLEN, M.D. F.A.C.S. Chicago, Illinois. University of Chicago College of Medicine and Argonne National Laboratory.
- A Comparison of Blood Volumes in Surgical Patients as Determined by Radioactive Phosphorus Tagged Red Cells and T-824 Dye. HERMAN M. NACHMAN, M.D., JOHN W. MOORE, Ph.D. and EVERETT IDRISS EVANS, M.D. F.A.C.S. Richmond, Virginia. Medical College of Virginia.
- Radioactive Isotopes as Diagnostic and Prognostic Aids in Peripheral Vascular Disease. MORRIS T. FRIDELL, M.D. F.A.C.S., FERTON SCHAFNER, M.D. and WILLIAM J. PICKETT, M.D. F.A.C.S., Chicago, Illinois. H. Kohn Institute for Medical Research, Cook County Hospital.
- Fluorescein as an Adjunct in the Treatment of Radionecrotic Ulcers. HERMAN RICE, M.D. and BROOKLYN S. FREEMAN, M.D. F.A.C.S. Temple, Texas. McCloskey Veterans Administration Hospital.
- The Use of Beta Irradiation for Corneal Scarring. WILLIAM H. BOYD, M.D. Los Angeles, California.

#### Gall Bladder, Pancreas, Intestines Miscellaneous

8:30 a.m. Friday—Philharmonic Auditorium

- WARREN H. COLE, M.D. F.A.C.S. Chicago. Professor of Surgery and Head, Department of Surgery, University of Illinois College of Medicine, Presiding.
- The Value of the Secretin Test in Surgery. HENRY DOUBILET, M.D. F.A.C.S. New York, New York. New York University College of Medicine.
- Gall Bladder Excretion Studies Following Gastric Resection. IVAN D. BARONOFFSKY, M.D., DAVID GATZEL, M.D. and EDWARD A. BOYDEN, M.D. Minneapolis, Minnesota. University of Minnesota Medical School.
- An Experimental Method of Repair of Common Duct Strictures. JOHN R. SCHIFFER, M.D., Chicago, Illinois. University of Illinois College of Medicine.
- The Role of the Sphincter of Oddi in the Prevention of Cholangitis. CHRISTIAN LAZARIN, M.D., WILLIAM T. FITZ, JR., M.D. and DAVID COOPER, M.D. Philadelphia, Pennsylvania. University of Pennsylvania School of Medicine and Hospital of the University of Pennsylvania.
- Total Pancreatectomy with Report of the Postoperative Physiological Studies. JACK GREENFIELD, M.D. and JACK H. SANDERS, M.D. Memphis, Tennessee. Veterans Administration Medical Teaching Group, Kennedy Hospital.
- The Cause of Death in Strangulation Obstruction. PAUL NEMTS, JR., M.D., H. R. HAWTHORNE, M.D. F.A.C.S., D. L. DRABMAN, M.D. and ISIDORE CORN, JR., M.D. Philadelphia, Pennsylvania. University of Pennsylvania School of Medicine.
- Effect of Streptomycin in Conditions Involving Infections of the Peritoneum. H. A. DAVIS, M.D. F.A.C.S. Los Angeles, California. Department of Surgery and Graduate School of Medicine, College of Medical Education.
- Experimental Mesenteric Vascular Occlusion. JOHN W. DERR, M.D. and RUDOLF J. NOER, M.D. F.A.C.S., Detroit, Michigan. Wayne University College of Medicine.

- The Use of Peritoneal Grafts to Reinforce Suture Lines Following Anastomosis of the Intestines **SPENCER T. CHESTER, M.D.** **FREDERICK BINKLEY, M.D.** **H. GLENN BELL, M.D.** **F.A.C.S.** and **HORACE J. McCORKLE, M.D.** **F.A.C.S.** San Francisco California University of California Medical School
- The Surgical Treatment of Heredofamilial Polyposis of the Colon **EARL J. BOXHINE, M.D.** Los Angeles California
- Experimental Use of a Skin Lined Tube in the Greater Omentum **J. R. MCCORRISTON, M.D.** and **D. W. MACKENZIE, JR., M.D.** Montreal Quebec McGill University Faculty of Medicine
- Studies on the Mechanism of Vomiting **R. M. WHITROCK, M.D.** and **HENRY L. TIECHER, M.D.** Ann Arbor Michigan University of Michigan Medical School
- The Use of Uretholine in Postoperative Distention **CLARENCE E. STAFFORD, M.D.** **F.A.C.S.** **ARTHUR I. KUGEL, M.D.** and **ALEXANDER DREDERER, M.D.** Los Angeles California College of Medical Evangelists
- The Physiological Effects of Curare Its Failure to Pass the Placental Membrane or Inhibit Uterine Contractions **PHYLLIS HARROUN, M.D.** and **CARL W. FISHER, M.D.** San Francisco California University of California Medical School

### *Vascular Surgery Blood Flow Urology*

*8:30 a.m. Friday—Ballroom The Biltmore Hotel*

- CLARENCE J. BERNE, M.D.** **F.A.C.S.** Los Angeles Professor of Surgery University of Southern California School of Medicine Preaching
- The Experimental Use of Vein Grafts in Establishing an Anastomosis Between the Portal and Systemic Systems **EDWARD SHARKEY, M.D.** Albany New York Albany Medical College
- Comparison of Suture Anastomosis Non-Suture Anastomosis and Polythene Tubing for Restoration of Circulation in the Critical Extremity **ALLAN D. CALLOW, M.D.** and **C. STUART WELCH, M.D.** **F.A.C.S.**, Boston Massachusetts Tufts College Medical School
- Acceleration of the Velocity of Venous Flow in the Deep Veins of the Lower Extremity of Man by Local Compression **JOSEPH R. STANTON, M.D.** **EDWARD D. FREIS, M.D.** and **ROBERT W. WILKINS, M.D.** Boston Massachusetts Boston University School of Medicine
- The Effect of Tetra Ethyl Ammonium Chloride on Peripheral Blood Flow **J. ROSS VEAL, M.D.** **F.A.C.S.** **JOHN N. SHADID, M.D.** and **WILLIAM L. JAMISON, M.D.** Washington District of Columbia George town University School of Medicine
- The Use of Tetra Ethyl Ammonium Chloride as a Vasodilator in Peripheral Vascular Disease Its Effect on Sympathectomized Extremities **JAMES B. FRENCH, M.D.** **WILLIAM E. ADOLPH, M.D.** and **TREODORE B. MASSELL, M.D.** Los Angeles California College of Medical Evangelists and Birmingham Veterans Administration Hospital
- The Rationale of Therapy in Acute Vascular Occlusions Based upon Micrometric Observations **HAROLD LAUFMAN, M.D.** **F.A.C.S.** **WAYNE B. MARTIN, M.D.** and **STANLEY W. TUELL, M.D.** Chicago Illinois Northwestern University Medical School
- A Method for Recording Arterial Pressure and Pressure Pulse Contours and Changes in the Circulation of Patients Studied by This Method **R. D. DRIFFS, M.D.** **K. F. EATHER, M.D.** and **L. H. PETERSON, Ph.D.** Philadelphia, Pennsylvania Hospital of the University of Pennsylvania and University of Pennsylvania School of Medicine
- Local Reaction to Oxidized Cellulose and Gelatin Hemostatic Agents in Experimentally Contaminated Renal Wounds **FRANK HIXMAN, JR., M.D.** and **KENWARD O. BARCOCK, M.D.** San Francisco California University of California Medical School
- The Effect of Temporary Renal Vascular Occlusion on Renal Function **CORNELIUS W. VERMEULEN, M.D.**, **JOHN R. SCHEIBE, M.D.** and **ERNEST GIRALDI, M.D.** Chicago Illinois University of Illinois College of Medicine
- Clinical Experiences with the Artificial Kidney **JOHN T. MACLEAN, M.D.** **CHARLES B. RUPSTEIN, M.D.** **NANNIE K. M. DE LEEUW, M.D.** and **G. GAVIN MILLER, M.D.** **F.A.C.S.** Montreal Quebec Royal Victoria Hospital and McGill University Faculty of Medicine
- Urinary Stress Incontinence Physiologic Restoration of Function of Sphincter Muscles **ARNOLD H. KEGEL, M.D.** **F.A.C.S.** Los Angeles California
- Uretero Sigmoid Anastomosis **JUSTIN J. CORDONNIER, M.D.** St. Louis Missouri Washington University School of Medicine



# TWENTY-SEVENTH ANNUAL HOSPITAL STANDARDIZATION CONFERENCE—

BILTMORE HOTEL LOS ANGELES

OCTOBER 18 TO 22 1948

*Monday 10:00 a.m. 12:30 p.m. — Ballroom*

Opening Session of the Clinical Congress—General Assembly

For program see outline of General Assembly program on preceding page

*Monday 2:00-4:00 p.m. — Ball room*

## Panel Discussions

Presiding HENRY T. JR., Spokane, Administrator, Deschutes Hospital, President, Association of Western Hospitals

A Message from the President of the Association of Western Hospitals

HENRY T. JR., Spokane.

*2:00-3:30 p.m.*

Panel Discussion—*New Developments in Medical Science and How They Affect Hospital Administrative Practices*  
Moderator CHARLES B. PETERSON, M.D., F.A.C.S., Chicago, Professor of Surgery, and Assistant Dean in Charge of Graduate Education—Surgery, University of Illinois College of Medicine and the Illinois Post-Graduate Medical School, Chief Surgical Consultant, Veterans Administration Hospital, Illinois

*Collaborators*

Surgery

JOEL W. BAKER, M.D., F.A.C.S., Seattle, Surgeon-in-Chief, Virginia Mason Hospital

Medicine  
BURRILL O. RAVISTON, M.D., Los Angeles, Professor of Medicine and Dean of the University of Southern California School of Medicine

Pathology

ALVIN C. FORD, M.D., Pasadena, Associate Professor of Pathology, University of Southern California School of Medicine and Director, Department of Pathology, Colby and Howard Huntington Memorial Hospital

Nursing

STELLA HELEN, R.N., Los Angeles, Director of Nurses, St. Vincent's Hospital

*3:30-3:45 p.m.*

Intermission

*3:45-5:00 p.m.*

Panel Discussion—*Trend of Hospital to Supply Facilities and Services for Members of the Medical Staff*

Moderator RITZ E. HERMAN, Los Angeles, Superintendent, The California Hospital

*Collaborators*

The Purposeful Use of the Staff Office in General Hospital  
JAMES K. STACE, M.D., F.A.C.S., Chicago, Assistant Professor of Bone and Joint Surgery, Northwestern University Medical School, Attending Surgeon, Passavant Memorial Hospital

Doctors' Professional Building Connected with the Hospital  
ROBERT L. SYDNOR, M.D., F.A.C.S., Memphis, Associate Professor of Clinical Surgery, University of Tennessee College of Medicine, Senior Consulting Surgeon, John Gaston Hospital

Use of One Floor of Hospital for Doctors to see Patients  
HERMAN SMITH, M.D., Chicago, Hospital Consultant.

## PRESIDENTIAL MEETING

*Monday 8:15-10:30 p.m. —*

*Philarmonic Hall*

Hospital Representative attending the Twenty-Seventh Annual Hospital Standardization Conference are most cordially invited to the Presidential Meeting and Reception following

*Tuesday 10:00 a.m. 12:30 p.m. — Music Room*

Symposium—*Current Medical-Administrative Advances in Hospital*

Presiding CLARENCE I. RIFE, M.D., F.A.C.S., San Diego, Surgeon, Merit and Diego County General Hospitals and Regional Clinic

Opening Remarks—The Purpose of the Session

CLARENCE I. RIFE, M.D., San Diego.

Integration of the General Practitioner in the Medical Staff Organization

CURTIS H. LOTT, M.D., Clayton, Missouri, Superintendent and Medical Director, St. Louis County Hospital

Hospital and Anesthesia

HENRY K. BRUCE, M.D., Boston, Dorr Professor of Research, Anesthesia, Harvard Medical School, Anesthetist in Chief, Department of Surgery, Massachusetts General Hospital

The Organization and Functioning of the Surgical Committee

FREDERICK G. KOLOUCH, M.D., Ph.D., F.A.C.S., T. in Falls, Idaho, Department of Surgery, T. in Falls Clinic  
The Need Organization and Functioning of Emergency Department in General Hospital (illustrated diagram slides)

ALFRED C. MATTLEY, Berkeley, Administrator and HENRY N. JACKSON, M.H.A., Assistant Administrator, Herrick Memorial Hospital

Discussion—Questions and Answers

Conducted by HERMAN SMITH, M.D., F.A.C.P., Chicago, Hospital Consultant, Formerly Superintendent, Michael Reese Hospital

*Tuesday 2:00-5:00 p.m. — Music Room*

Presiding WILLIAM P. BUTLER, San Jose, Manager, San Jose Hospital

Regional Hospital Planning

GORDON A. F. EYEN, Kitchener, Ontario, Administrator, Kitchener-Waterloo Hospital

The Evaluation of Integrated Clinical and Research Program in Cancer in Large General Hospital

IAN MACDONALD, M.D., C.M., F.A.C.S., Los Angeles, Assistant Clinical Professor of Surgery, University of Southern California School of Medicine, Attending Surgeon, Tumor Surgery, Los Angeles County Hospital

Maintaining Standards Notwithstanding Rising Hospital Costs.

CLARENCE E. WYMACOTT, Salt Lake City: Administrator Dr. W. H. Groves, Latter Day Saints Hospital. Developing Leadership Through Good Supervision. KENNETH WILLIAMSON, Chicago: Assistant Director American Hospital Association.

Tuesday 8:00-10:00 p.m. — Music Room

Panel Discussion—Evaluating the Various Departments and Services of the Hospital According to the Plan of the Point Rating System

Conducted by MALCOLM T. MACEachern, M.D., C.M.F.A.C.H.A., Chicago: Associate Director American College of Surgeons and HENRY G. FARISH, M.D., M.H.A., Southampton, New York: Superintendent Southampton Hospital

Physical Plant

CORNELIUS GRAY, Los Angeles: Chief Engineer The California Hospital.

Administration

PAUL C. ELLIOTT, Los Angeles: Executive Secretary and Administrator Hollywood Presbyterian Hospital Olmsted Memorial

Medical Staff Organization

E. VINCENT ARKEY, M.D., F.A.C.S., Los Angeles: Instructor in Surgery, University of Southern California School of Medicine. Member Senior Surgical Staff St. Vincent's Hospital

Medical Records Department

NORMA BALMANN, R.R.L., Indianapolis: President Elect American Association of Medical Record Librarians. Medical Record Librarian, Methodist Hospital

Clinical Laboratory

GEORGE D. MANER, M.D., Los Angeles: Pathologist, Good Samaritan Hospital. President, California Society of Pathologists

X-Ray Department

ROY LAMAR FIELDER, M.D., Los Angeles: Radiologist, Methodist Hospital, President, Radiological Society of the Los Angeles County Medical Association

Nursing Service

HELEN MCKILLIP, R.N., Los Angeles: Director of Nurses, Hollywood Presbyterian Hospital-Olmsted Memorial

Dietary Department

JUANITA KENZERICK, Los Angeles: Dietitian Children's Hospital

Surgical Department

LEWIS A. ALEXSEN, M.D., F.A.C.S., Los Angeles: Associate Clinical Professor of Surgery, College of Medical Evangelists. Secretary, Los Angeles Surgical Society

Obstetrical Department

CARL E. KRICHMEIER, M.D., Los Angeles: President, Obstetrical Society, Los Angeles County Medical Association

Anesthetic Department

J. WILLIAM SHUMAN, JR., M.D., Los Angeles: President Anesthesia Section, Los Angeles County Medical Association

Physical Therapy Department

LOUIS P. BING, M.D., Los Angeles: Director of Physical Medicine, California and Santa Monica Hospitals.

School of Nursing

ZELLA NICOLAS, R.N., M.A., Los Angeles: Director of Nurses, The California Hospital, Chairman, Southern California Chapter California League of Nursing Education

Outpatient Department

BEN A. NEWMAN, M.D., Los Angeles: Chairman Out

Patient Committee, Cedars of Lebanon Hospital

Pharmacy

CHARLES HAGAN, Santa Monica: Chief Pharmacist Santa Monica Hospital. Chairman, Pharmacists Section, Association of Western Hospitals.

Medical Social Service Department

HELEN E. BOARDMAN, R.S.W., Los Angeles: Director of Social Service, Children's Hospital. Vice-Chairman, Medical Social Workers Section, Association of Western Hospitals.

Occupational Therapy Department

MARIAN DAVIS, Los Angeles: President, Occupational Therapists Section, Association of Western Hospitals.

Wednesday 7:45-9:45 a.m. — Conference Room No. 2

Breakfast Conference—Joint Session for Press and Radio Representatives and Hospital Personnel

Wednesday 10:00 a.m.-12:30 p.m. — Music Room

Panel Discussion—A Survey of Special Problems as Related to Hospital Standardization in Its Approval Program

Wednesday 2:00-5:00 p.m. — Music Room

Joint Session with the American Association of Medical Record Librarians.

Conducted by G. OTIS WHITECOTTON, M.D., Oakland: Medical Director, Highland-Alameda County Hospital. Introduction to Discussion.

SISTER MARY SERVATIA, S.S.M., R.R.L., St. Louis, Missouri: President, American Association of Medical Record Librarians. Medical Record Librarian, St. Mary's Hospital.

Panel Discussion—The Statistical Data Content of Hospital Reports

Moderator: EDNA K. HUFFMAN, R.R.L., Chicago: Field Representative American Association of Medical Record Librarians.

Collaborators

Deaths—

MARGARET TAYLOR, R.R.L., Rochester, New York: Medical Record Librarian, Rochester General Hospital

Infections—

GERTRUDE GUNN, R.R.L., Indianapolis: In Charge of the Medical Record Department, Indiana University Medical Center

Autopsies—

VIRGINIA KELLOGG, R.R.L., R.N., Seattle: Director Medical Records, The King County Hospital.

Consultations—

CLEO B. NELSON, R.R.L., San Francisco: In charge of Record Room, San Francisco Hospital

The Point Rating System for Hospitals and Its Application. HENRY G. FARISH, M.D., M.H.A., Southampton, New York: Superintendent, Southampton Hospital.

The Medical Audit.

MALCOLM T. MACEachern, M.D., Chicago: Associate Director, American College of Surgeons.

Discussion—Questions and Answers.

Conducted by G. OTIS WHITECOTTON, M.D., Oakland.

Wednesday 8:00-10:00 p.m. — Music Room

Joint Session for Hospital Trustees, Physicians and Hospital Administrators.

RITZ E. HEDERMAN, F.A.C.H.A., Los Angeles: Superintendent, The California Hospital, Presiding

Recent Interpretation by the Attorney General of California with Reference to What Constitutes the Practice of Medicine by Corporations.

HONORABLE JUDGE R. MORGAN GALBRETH, Los Angeles

les Trustee Hollywood Presbyterian Hospital—Olmsted Memorial.  
The Reaction of Hospital Trustees to the Controversy on the Resolutions of the Los Angeles County Medical Association.

COLLIS P. HOLLIDAY Pasadena Trustee, Collis P. and Howard Huntington Memorial Hospital.

#### Open Forum.

The General Responsibilities of Hospital Trustees.

Moderator JAMES A. HAMILTON F.A.C.H.A., Minneapolis Professor and Director Course in Hospital Administration, University of Minnesota. Hospital Consultant. Collaborators ROLLAND MAXWELL, Los Angeles President, Board of Directors, Methodist Hospital of Southern California.  
HOWARD BURRELL, Los Angeles, Trustee, The California Hospital.

Thursday 10:00 a.m.—12:30 p.m.—Music Room

Round Table Conference—Common Problems of the Small Hospital in Maintaining Acceptable Standards for the Care of the Sick and Injured.

Conducted by P. W. H. FISLER, Oklahoma City.

The program for this session will embrace survey and study of pertinent problems as related to the organization, management and services of the small hospital in serving its community through adhering to the standards of the American College of Surgeons.

Thursday 2:00—5:00 p.m.—Music Room

Forum—Trend in Hospital Administration New Ideas and Procedures and Special Hospital Problems.

Conducted by FRANK R. BRADLEY, M.D., F.A.C.H.A., St. Louis Director Barnes Hospital Professor of Hospital Administration, Washington University School of Medicine.

Opportunity is being given to the graduates and administrative interns of the various Universities now offering courses in hospital administration to present summary transcripts of new ideas and trends in hospital work, including planning and construction, improved equipment, new procedures and techniques, administrative problems, personnel management, public relations and other phases of hospital administration. The names of contributors to this program and subjects of their presentations

will appear in a special program issued at the Clinical Congress.

Thursday 8:00—10:00 p.m.—Music Room

Paper Discussion—Nursing the Patient

Moderator JOSEPH R. CLEMMONS, M.D. New York Medical Director Roosevelt Hospital.

#### Collaborators

The Present Situation in Nurse Recruitment and Nursing Service in Hospitals.

PEARL McIVER, R.N. Washington President, American Nurses Association Director of Public Nursing, U.S. Public Health Service.

Comments on the Report of the Committee of the American Medical Association on Nursing Problems.

HOWARD C. NAFFERTY, M.S., M.D., F.A.C.S. San Francisco Professor of Surgery University of California Medical School Surgeon-in-Chief, University of California Hospital.

FRANK R. BRADLEY, M.D. F.A.C.H.A. St. Louis Director Barnes Hospital Professor of Hospital Administration, Washington University School of Medicine.

MARGUERITE L. MACLEAM, R.N. Oakland Director of Nurses, Highland Alameda County Hospital.

Auxiliary Workers in the Field of Nursing.

The Present Status of the Nurses Aide in the Nursing of the Patient.

GEORGE F. WOLFGAST, M.D. F.A.C.S. Denver Assistant in Surgery University of Colorado School of Medicine, Member of Staff, Surgery St. Luke and St. Joseph's Hospitals.

b. Volunteer Workers in the Nursing Services—Scope, Availability and Control.

M. LOUISE FLOYD, R.N., Los Angeles Director Nursing Service, American Red Cross, Los Angeles Chapter.

My Conception of Efficient Nursing Service in our Hospitals.

ANTHONY J. J. ROONEY, M.D. F.A.C.H.A., San Francisco Director Stanford University Hospitals.

Friday Morning and Afternoon

Visits to hospitals in Los Angeles and vicinity arranged with the Hospital Council of Southern California.

# PRELIMINARY CLINICAL PROGRAM

## PARTICIPATING HOSPITALS AND HOSPITAL CLINICS COMMITTEE

The California Hospital, Los Angeles—William F. Quinn M.D.  
 Cedars of Lebanon Hospital, Los Angeles—Adolph A. Kutzmam M.D., F.A.C.S.  
 Children's Hospital, Los Angeles—J. Norton Nichols, M.D. F.A.C.S.  
 French Hospital, Los Angeles—Pierre Paul Viole, M.D.  
 Hollywood Presbyterian Hospital—Olmsted Memorial—William H. Snyder M.D., F.A.C.S.  
 Hospital of the Good Samaritan, Los Angeles—Francis M. McKeever, M.D.  
 Collis P. and Howard Huntington Memorial Hospital, Pasadena—Leroy B. Sherry M.D., F.A.C.S.  
 Los Angeles County Hospital, Los Angeles—Clarence J. Berne, M.D., F.A.C.S.  
 Los Angeles Sanitarium—Alfred Goldman, M.D.  
 Methodist Hospital of Southern California, Los Angeles—Paul A. Quaintance M.D., F.A.C.S.  
 Orthopaedic Hospital, Los Angeles—Ward M. Rolland, M.D., F.A.C.S.  
 Physicians and Surgeons Hospital, Glendale—John R. Paxton, M.D., F.A.C.S.

Queen of Angels Hospital, Los Angeles—Donald E. Ross, M.D., F.A.C.S.  
 St. John's Hospital, Santa Monica—George Arnold Stevens, M.D., F.A.C.S.  
 St. Joseph Hospital, Burbank—Ralph H. Walker, M.D., F.A.C.S.  
 St. Luke Hospital, Pasadena—James M. Marshall, M.D., F.A.C.S.  
 St. Vincent's Hospital, Los Angeles—William P. Kroger, M.D., F.A.C.S.  
 Santa Fe Coast Lines Hospital, Los Angeles—Richard J. Flammson, M.D., F.A.C.S.  
 Santa Monica Hospital, Santa Monica—Leo J. Madsen, M.D., F.A.C.S.  
 U.S. Army McCornack General Hospital, Pasadena—Colonel Lawrence C. Ball, M.C., U.S.A.  
 U.S. Naval Hospital, Long Beach—Captain F. C. Hill, M.D.  
 U.S. Veterans Administration, Birmingham General Hospital, Van Nuys—Joseph A. Weinberg, M.D., F.A.C.S.  
 U.S. Veterans Administration Center, Wadsworth General Hospital, Saticum—Francis R. A. Byron, M.D., F.A.C.S.  
 White Memorial Hospital, Los Angeles—Clarence E. Stafford, M.D., F.A.C.S.

## CLINICS IN LOS ANGELES AND VICINITY HOSPITALS

### THE CALIFORNIA HOSPITAL, LOS ANGELES

#### Tuesday

8:00-12:00. *General Surgery* Operative Clinics  
 Gastrointestinal Surgery—Vagotomy and Gastroenterostomy. JACK M. FARRIS and ASSOCIATES.  
 Two Team Abdominal Perineal. MALCOLM R. HILL and ASSOCIATES.  
 Gastric Resections. WILLIAM F. QUINN, NORMAN L. CARDEY

#### Wednesday

8:00-12:00. *General Surgery* Operative Clinics  
 Carcinomas of Face, Neck, and Breast. Los Angeles Tumor Institute Staff  
 Carcinoma of the Stomach. LENTZ A. ALLEN  
 Thoracic Surgery Operative Clinic.  
 Carcinoma of Lung. LYMAN A. BREWER and ASSOCIATES.

#### Thursday

8:00-12:00. *General Surgery* Operative Clinics  
 Lesions of Thyroid. O. DALE LLOYD  
 Cholecystic Disease. WILLIAM HENRY OLDS and ASSOCIATES.  
 Hernioplasty. FREDERICK W. LEIX and ANTON LAUBER SHREINER.

#### Friday

8:00-12:00. *Obstetrics and Gynecology* Operative Clinics  
 Total Hysterectomy. DONALD G. TOLLESON and ASSOCIATES.  
 Vaginal Hysterectomy. PAULA HORN and ASSOCIATES.  
 Total Hysterectomy. WILLIAM H. BROWNFIELD and ASSOCIATES.

Low Cervical Section and other Gynecological Procedures. RALPH J. THOMPSON, GEORGE W. HEWITT and AARON NEAL WEBB

### CEDARS OF LEBANON HOSPITAL, LOS ANGELES

#### Tuesday

10:00-12:00. *General Surgery* Operative Clinic. Thyroidectomy. MAURICE G. KAHN, MAX W. BAY  
 10:00-12:00. *Gynecology* Operative Clinic. Selected cases. EMIL J. KRAHLICK  
 10:00-12:00. *Genitourinary Surgery* Operative Clinic. Selected cases. JAMES STEINBERG.

#### Wednesday

10:00-12:00. *General Surgery* Operative Clinic. Smithwick Operation. MARCUS H. RABINOW  
 10:00-12:00. *Neurosurgery* Operative Clinic. Selected cases. TRACY PUTNAM.

#### Thursday

10:00-12:00. *General Surgery* Operative Clinic. Abdominal surgery. ISAAC V. OLICH  
 10:00-12:00. *Gynecology* Operative Clinic. Selected cases. JOSEPH W. HARRIS, LEON KROHN  
 10:00-12:00. *Genitourinary Surgery* Operative Clinic. Selected cases. JAMES STEINBERG

#### Friday

10:00-12:00. *General Surgery* Operative Clinic. Selected cases. SAM S. HERSHKOFF  
 10:00-12:00. *Thoracic Surgery* Operative Clinic. Selected cases. ALFRED GOLDMAN

## Tuesday through Friday

9:00-12:00. *General Surgery* Nonoperative Clinics.  
Smith's Operation, Colectomy, Gall Bladder-Thyroid Roentgenology Pathology MARCUS H. RABINOWITZ  
D. TO H. ROSENBLUM, MAX W. B. Y. ISAAC Y. OLICH,  
Members of Thyroid Committee, EUGENE FREEDMAN  
N. I. HEDMAN

## CHILDREN'S HOSPITAL, LOS ANGELES

## Monday

*Thoracic Surgery* Operative Clinics.  
Blalock Operation Bronchoscopies. JOHN C. JONES.  
*Oral Surgery* Operative Clinics.  
Cleft Palates Cleft Lips. EMIL F. THOLEN.  
*Oribo-pedic Surgery* Operative Clinics.  
Hip Fusion Triple Arthrodesis. Bloopay of Knee. JOHN C. WILSON.  
9:00-10:00 *Thoracic Surgery* Nonoperative Clinics.  
Patent Ductus Arteriosus The Blalock Operation.

## Tuesday

*Otolaryngology* Operative Clinics.  
Tonsillectomy and Adenoidectomy. MUSTOIDECTOMY  
ALDEN MILLER.  
*Plastic Surgery* Operative Clinics.  
Pudgett Grafts Reconstruction Ear. Excision of Nevus  
th Graft. WILLIAM S. KIRKADDERN.  
*Ophthalmology* Operative Clinics.  
Recession and Resection, Tuck and Recession. O'Connor  
Cinch Ptoisis, Motals. A. RA. IRVING.  
9:00-10:00 *Plastic Surgery* Nonoperative Clinic.  
Immediate and Late Results Obtained in the Treatment  
of Burns.

## Wednesday

*General Surgery* Operative Clinics.  
Herniorrhaphy. Orchopepy; Appendectomy. Thyroid  
gland Cyst. LAW. VOR. CHAFFIN.  
*Thoracic Surgery* Operative Clinics.  
Coarctation Patent Ductus. JOHN C. JONES.  
9:00-10:00 *General Surgery* Nonoperative Clinic.  
General Pediatric Problems in Childhood.

## Thursday

*Genitourinary Surgery* Operative Clinics.  
Nephrectomy. Bladder Neck Resection. Cystoscopies.  
O. W. BUCKLEY.  
*Oribo-pedic Surgery* Operative Clinics.  
Spinal Fusion. Arthrodesis (Britton type). JOHN C.  
WILSON.  
*Proctology* Operative Clinic.  
Rectovaginal Fistula. KENNETH E. SMILEY.  
*Endoscopy* Operative Clinics.  
Bronchoscopy. Laryngoscopy. ALDEN MILLER.  
*Neurosurgery* Operative Clinics.  
Cerebellar Exploratory. Choroid Plexectomy. Bone flap.  
CARL W. RAND.  
9:00-10:00 *Oribo-pedic Surgery* Nonoperative Clinic.  
Clinical Diagnostic Problems.  
*Neurology* Nonoperative Clinic.  
Brain Tumors in Childhood.

## Friday

*Otolaryngology* Operative Clinic.  
Tonsillectomy and Adenoidectomy. ALDEN MILLER.  
*General Surgery* Operative Clinics.  
Pyroplasty. Herniorrhaphy. WILLIAM J. NORRIS,  
JAMES NORMAN NICHOLS

*Ophthalmology* Operative Clinics.  
Recession and Resection. Enucleation. Ptoisis. A. RA. IRVING.  
9:00-10:00 *Ophthalmology* Nonoperative Clinic.  
Squint and Muscle Surgery.  
*Otolaryngology* Nonoperative Clinics.  
Acute Obstructive Laryngitis.

## FRENCH HOSPITAL, LOS ANGELES

## Wednesday

9:00-10:00. *Tumor Surgery* Nonoperative Clinic. Rad-  
ical Cancer Surgery of Head and Neck—alides—ones  
SAM L. PERKIN.  
9:00-10:00. *Tumor Surgery* Nonoperative Clinic. Com-  
bined Attack of Cancer of Head and Neck—alides—  
ones. CLYDE K. EMERY.  
10:00-11:00. *Tumor Surgery* Nonoperative Clinic. Be-  
nign Tumors of Neck—alides. ALONSO POLLAK.  
11:00-12:00. *General Surgery* Nonoperative Clinic. Re-  
moval of Thyrogland Duct Cyst—motion pictures.  
ELMER J. BALL.

## Wednesday Afternoon

Round Table Discussion. ARTHUR J. MCDONNELL,  
FRED GASPARD IVY LOFFELICH, VICTOR CAPALL,  
FREDERICK P. L. VIGOR.

HOLLYWOOD PRESBYTERIAN HOSPITAL—  
OLMSTED MEMORIAL

## Tuesday

8:00-10:00. *Tumor Surgery* Nonoperative Clinic.  
Cases Presented 10th Followup. C. HIRAM WEAVER  
and STAFF.

## Wednesday

8:00-10:00. *Tumor Surgery* Operative Clinics.  
Radical Mastectomy with Castory. C. HIRAM WEAVER  
and STAFF.  
9:00-10:00. *Genitourinary Surgery* Operative Clinic.  
Urological Surgery STAFF.  
8:00-10:00. *General Surgery* Operative Clinics.  
Thyroidectomy. Gastric Resection. Lobectomy. STAFF.  
9:00-10:00. *General Surgery* Nonoperative Clinic.  
Nonurgical treatment for Genital Relaxation including  
Urinary Incontinence, with Exhibit. ARTHUR H.  
KROHL.  
10:00-11:00. *General Surgery* Nonoperative Clinic.  
Traumatic Injuries to Abdomen. DONALD C. COLLIER.

## Thursday

8:00-10:00. *General Surgery* Operative Clinic.  
Selected Cases. STAFF.  
9:00-10:00. *Plastic Surgery* Operative Clinic.  
Mastopexy. HERBERT OTTO BAKER.  
10:00-11:00. *Plastic Surgery* Nonoperative Clinic.  
Demonstration Plastic Technique. HERBERT OTTO  
BAKER.

HOSPITAL OF THE GOOD SAMARITAN,  
LOS ANGELES

## Tuesday

8:00-10:00. *General Surgery* Operative Clinic. Selected  
Cases. LAWRENCE CHAFFIN, WILLIAM J. NORRIS.  
8:00-10:00. *Thoracic Surgery* Operative Clinic. Selected  
Cases. JOHN C. JONES.  
8:00-10:00. *Neurosurgery* Operative Clinic. Selected  
Cases. GEORGE H. PATTERSON.

## CLINICAL CONGRESS 1948

The Need of More Radical Surgery in Gastric Carcinoma.  
HAROLD LINCOLN THOMPSON

Thursday

Wednesday  
8:00-12:00 General Surgery Operative Clinic Selected Cases. PHILIP J. CUNNAME.  
8:00-12:00 Genitourinary Surgery Operative Clinic: Selected Cases. KENNETH E. SMILEY  
8:00-12:00 Neurosurgery Operative Clinic Selected Cases. CARL W. RAND  
9:00-12:00 Ophthalmology Operative Clinic Selected Cases. GEORGE P. LAMBERG

Thursday

8:00-12:00 General Surgery Operative Clinic Selected Cases. CLARENCE J. BERNIE, JAMES NORTON NICHOLS  
KENNETH W. BLAKE  
8:00-12:00 Thoracic Surgery Operative Clinic Selected Cases. FRANK S. DOLLEY  
Otorhinolaryngology Operative Clinic Selected Cases. P. SHUMAKER

Friday

8:00-12:00 General Surgery Operative Clinic Selected Cases. LAWRENCE CHAFFIN  
8:00-12:00 Genitourinary Surgery Operative Clinic Selected Cases. WILLIAM H. KROGER  
8:00-12:00 Gynecology Operative Clinic Selected Cases. HENRY M. SHAW  
8:00-12:00 Orthopedic Surgery Operative Clinic Selected Cases. JOHN C. WILSON

COLLIS P. AND HOWARD HUNTINGTON  
MILMORAL HOSPITAL, PASADENA

Tumor Surgery Operative Clinic  
Selected Cases. GEORGE S. SHARP, EUGENE W. DEMARCE.  
Plastic Surgery Operative Clinic  
Correction of Burn Contractures. GEORGE V. WEBSTER.  
Gas Therapy Operative Clinic  
Application of Intermittent Positive Pressure Breathing for Control of Respiratory Depression. JOHN B. DILLON  
Orthopedic Surgery Operative Clinic  
Early Recognition and Treatment of Congenital Hip. JOSEPH CHARLES RISER  
General Surgery Operative Clinic  
Abdominal Surgery in the Aged and Portacaval Anastomoses in Cirrhosis of the Liver. ARTHUR C. PATTISON  
Pathology Nonoperative Clinic  
Tumors and Cysts of the Ovary—A Pathologic Demonstration. ALVIN G. FOORD  
General Surgery Nonoperative Clinic  
The Cardiac Risk in Surgery. GEORGE GRIFFITH  
Tumor Surgery Nonoperative Clinic  
Tumor Clinic Demonstration—Selected Cases to Show the Operation of a Diagnostic Tumor Clinic in a Voluntary Hospital. EDWARD D. KREMER and STAFF

LOS ANGELES COUNTY HOSPITAL,  
LOS ANGELES

Monday

9:00 General Surgery Nonoperative Clinic  
Symposium on Esophageal and Gastric Disease. HAROLD L. COLX THOMPSON  
Surgery I Carcinoma of the Esophagus. LYMAN A. BREWER  
Hbatus Hernia Surgical Management. JOSEPH L. ROBINSON  
Vagus Resection in Treatment of Peptic Ulcer. JOSEPH L. WINTERGRO  
Surgical Management of Massive Hemorrhage from the Upper Gastrointestinal Tract. E. ERIC LARSON

8:00 Genitourinary Surgery Operative Clinic  
Intravascular Retropublic Prostatectomy. TRACY O. POWELL  
Transurethral Prostatic Resection. ROGER W. BARNES.  
Thoracic Surgery Operative Clinic  
Pneumectomy. FRANK S. DOLLEY, LYMAN A. BREWER

Thoracic Surgery Nonoperative Clinic  
Discussion on Problems of Anesthesia in Thoracic Surgery. JOHN B. DILLON  
Tumor Surgery Operative Clinic  
The Commando Type of Operation for Carcinoma of the Floor of the Mouth. SAMUEL L. PERRET, LEWIS W. GUTH

Discussion during surgery of the Problem of Intraoral Cancer. IAN MACDONALD

General Surgery Operative Clinics  
Radical Mastectomy. LAWRENCE CHAFFIN  
Discussion during surgery. PHILIP J. CUNNAME.  
Thyroidectomy. PHILIP J. CUNNAME.  
Discussion during surgery. LAWRENCE CHAFFIN  
Portacaval Shunt. ARTHUR C. PATTISON  
Discussion during surgery. WILLIAM H. KROGER.  
Cholecystectomy. WILLIAM H. KROGER.  
Discussion during surgery. ARTHUR C. PATTISON  
9:30 General Surgery Nonoperative Clinics  
Thyroid Symposium. CONRAD J. BAUMGARTNER, Mod

erator  
Hazards of Thyroidectomy. LEWIS F. ELLMORE.  
Organic Blood Iodine Levels Observed in Diagnosis and Treatment of Thyroid Disease. EUGENE J. JOERGENSON

The Problem of the "Aberrant Thyroid." CLARENCE J. BERNIE.

The Newer Anti Thyroid Drugs. PAUL STARR  
The Use of Radioactive Iodine in the Treatment of Thyroid Disease. MYRON PRINGMETAL

Genitourinary Surgery Nonoperative Clinics  
Discussion of Methods of Prostatectomy. TRACY O. POWELL, Moderator  
Endoscopic Identification of Tissue during Transurethral Prostatic Resection (Antemortem slide demonstration). ROGER W. BARNES, Moderator  
10:00 Genitourinary Surgery Operative Clinics.  
Nephrolithotomy. ADOLPH A. KUTTMANN  
Transurethral Resection of Bladder Tumor. R. THEODORE BERGMAN  
11:30 Genitourinary Surgery Nonoperative Clinics  
Discussion of Renal Surgery for Stone. ADOLPH A. KUTTMANN  
Discussion of Endoscopic Treatment of Bladder Tumor. R. THEODORE BERGMAN

Wednesday

8:00-12:00 General Surgery Operative Clinic  
Gastric Resection. E. ERIC LARSON  
Discussion during surgery. CLARENCE J. BERNIE.  
General Surgery Nonoperative Clinic  
Problem of Gastric Surgery in a Private Hospital Types of Resection Operative Clinic Morbidity and Mortality Results.  
General Surgery Operative Clinics  
Common Duct Stone. CLARENCE J. BERNIE  
Discussion during surgery. JOHN R. PAXTON  
Vagotomy and Gastroenterostomy. EUGENE J. JOERGENSON

- Results of Vagotomy at Los Angeles County General Hospital.* HARRY C. PROCT
- General Surgery Nonoperative Clinic:*  
Causes of Upper Gastro-Intestinal Bleeding (Illustrated) HAROLD LI COLIN THOMPSON
- General Surgery Operative Clinic:*  
Resection of Lesion of Cardiac End of Stomach. HAROLD LINCOLN THOMPSON
- Discussion during surgery. EUGENE J JOERGESON.
- General Surgery Nonoperative Clinic:*  
Problems of Anesthesia in Thoracoabdominal Approach to Cardiac End of Stomach. JOHN B. DILLON
- Proctology Operative Clinics:*  
Repair of the Incontinent Anal Sphincter. PAUL C. H. WADDELL
- Anal Flapure. P. U. C. BLAIRHILL
- Abdominoperineal Resection—Two-term. MALCOLM R. HILL and ASSOCIATES
- Obstetrics and Gynecology Operative Clinics:*  
Vaginal Hysterectomy. CARL E. KRUMHELFER
- Discussion during surgery. WILLIAM C. BRADBURY
- Total Hysterectomy. WILLIAM C. BRADBURY
- Discussion during surgery. CAR E. KRUMHELFER
- Orthopedic Surgery Operative Clinics:*  
Spinal Fusion. JOSEPH CHARLES RIESER
- Discussion during surgery. G. MOSSER TAYLOR.
- Intraosseous Fracture, The Neufeld Nail. G. MOSSER TAYLOR.
- Discussion during surgery. ALONZO J. NEUFELD.
- Orthopedic Surgery Nonoperative Clinics:*  
Discussion between cases—Anatomical Considerations of the Region of the Hip. CHRISTOPHER MARION Moderator
- Problems of Anesthesia. JOHN B. DILLON
- 9:30 *Tumor Surgery Nonoperative Clinics:*  
Malignancy Symposium. LAW MACDONALD Moderator
- Combined Procedures for Intraocular Cancer. 11th Cervical Metastases. LEWIS W. GUTH, SAMUEL L. PERLBERG
- Detection and Management of Biologically Inoperable Mammary Carcinoma. LEO M. LIVI
- Diagnosis and Treatment of Uterine Carcinoma (Cervix Corpus). JUSTIN J. STEIN

#### Thursday

- 8:00-10:00. *Obstetrics and Gynecology Operative Clinics:*  
Suspension of Vaginal Vault from Abdominal Route. HEREY V. SHAW
- Manchester Operation. HAROLD K. MARSHALL
- Proximal Neurectomy. ELLIS HENRIKSEN
- Genitourinary Surgery Operative Clinics:*  
Nephrectomy (with discussion). J. Y. CRANE
- Retropubic Prostatectomy. SAMUEL K. BACON, FRIEDERICK A. BICKNELL
- Perineal Prostatectomy. CARL F. RUSCHLE, DONALD A. CHARNOCK
- Thoracic Surgery Operative Clinic:*  
Lobectomy. JOSEPH L. ROBINSON
- Discussion during surgery. JOHN C. JONES
- Neurosurgery Operative Clinics:*  
Thoracolumbar Sympathectomy. RUPERT B. RANNEY
- GEORGE H. P. TYBROOK
- Cervical Disc. AIDAN A. RANNEY, HERBERT O. CROCKETT
- Brain Tumor. PHILIP J. VOGLF, FRANK M. ANDERSON
- Supradaphragmatic Sympathectomy (Feet Operation). EMIL SELETT, HENRY MICHAEL CUNEO
- General Surgery Operative Clinic:*  
Thyroidectomy. CLARENCE E. STAFFORD
- Discussion of Thyroid Problems. CONRAD J. BAUMGARTNER

- General Surgery Nonoperative Clinic:*  
Discussion—Differential Diagnosis of Tumor of the Neck (Illustrated with charts and models).
- General Surgery Operative Clinic:*  
Branchial Pilonctomy. CONRAD J. BAUMGARTNER
- Discussion of Congenital Lesions of the Neck. CLARENCE E. STAFFORD
- 9:30. *Orthopedic Surgery Nonoperative Clinic:*  
Fractures. VERNON P. THOMPSON Moderator
- Fractures and Dislocations of the Hip. Fracture of the Femur. Fracture of the Tibia. SAMUEL S. MATTEN, PAUL E. McMASTERS, G. MOSSER TAYLOR, ALONZO J. NEUFELD

#### Friday

- 8:00-10:00. *Proctology Operative Clinics:*  
Abdominoperineal Resection. ROBERT L. BELL, WILLIAM H. DIXIE
- Fistulotomy
- Hemorrhoidectomy
- Anal Uter Excision
- Orthopedic Surgery Operative Clinics:*  
Amputation. FRANCIS M. McKEEVER
- Open Reduction Fractured Tibia. PAUL E. McMASTERS
- Osteotomy of Hip. VERNON P. THOMPSON
- Discussion between cases.
- Tumor Surgery Operative Clinic:*  
Radical Mastectomy. EUGENE J. JOERGESON
- Discussion of Cancer of Breast. JUSTIN J. STEIN
- Tumor Surgery Nonoperative Clinic:*  
Biopsy Techniques—Discussion between cases. CLARENCE E. NEILSON
- Tumor Surgery Operative Clinic:*  
Radical Neck Dissection. JUSTIN J. STEIN
- Discussion during surgery. CLARENCE E. NEILSON, EUGENE J. JOERGESON
- General Surgery Nonoperative Clinic:*  
Anatomy of Inguinal and Femoral Regions (Demonstration with charts). COL. LAWRENCE BALL, GORDON K. SMITH
- General Surgery Operative Clinic:*  
Surgical Repair of Indirect Inguinal Hernia. COL. LAWRENCE BALL, GORDON K. SMITH
- General Surgery Nonoperative Clinic:*  
Survey of Hernia Repair. McCormack General Hospital and Los Angeles County General Hospital (from June, 1946 to June, 1948 (charts and discussion)). COL. LAWRENCE BALL, GORDON K. SMITH
- General Surgery Operative Clinic:*  
Surgical Repair of Direct Inguinal Hernia. COL. LAWRENCE BALL, GORDON K. SMITH
- General Surgery Nonoperative Clinic:*  
General Discussion of Anesthesia in Elective and Emergency Surgical Procedures for Repair of Hernia. JOHN B. DILLON
- General Surgery Operative Clinic:*  
Surgical Repair of Femoral Hernia. COL. LAWRENCE BALL, GORDON K. SMITH
- General Discussion.
- General Surgery Operative Clinic:*  
Obstructive Jaundice (Stone Common Duct). JAMES NORTON NICHOLS
- General Discussion. LEWIS A. ALLEN
- General Surgery Nonoperative Clinic:*  
Discussion between cases—The Diagnosis of the Acute Abdomen in Children. JAMES NORTON NICHOLS
- General Surgery Operative Clinic:*  
Subtotal Gastrectomy Illustrating Use of Alsen T. LEWIS A. ALLEN
- Discussion during surgery. JAMES NORTON NICHOLS

# CLINICAL CONGRESS 1948

**General Surgery** Nonoperative Clinic  
Symposium on Fluid, Nitrogen, and Electrolyte Balance.  
CLARENCE J. BERRY, Moderator  
General Review of Current Concepts J. M. FARRIS.  
Discussion of Nitrogen Balance HARVEY A. DAVIS.  
Discussion of Acid Base Balance RALPH E. HODMAN.  
Presentation of Illustrative Cases. HELEN E. MARTIN.

## LOS ANGELES SANITARIUM DUARTE

### Tuesday

8:00-12:00 **Thoracic Surgery** Operative Clinic:  
Total Pleurectomy and Pneumonectomy for Pulmonary  
Tuberculosis. ALFRED GOLDMAN  
3:30-5:30 **Thoracic Surgery** Nonoperative Clinic  
Case Presentations Demonstrating Indications for Sur-  
gical Management of Pulmonary Tuberculosis with  
Special Emphasis on Indications for Surgical Resection  
of the Lung. ALFRED GOLDMAN JACOB SEGAL.

## METHODIST HOSPITAL OF SOUTHERN CALIFORNIA LOS ANGELES

### Monday

8:00-12:00. **Thoracic Surgery** Operative Clinic:  
Selected Cases LYMAN A. BREWER FRANK S. DOLLEY  
8:00-12:00. **Tumor Surgery** Operative Clinic Selected  
Cases CLYDE EMMERY TUMOR GROUP SAMUEL L. PERLBERG  
8:00-12:00. **Orthopedic Surgery** Operative Clinic Selected  
Cases HAROLD E. CROWL KENNETH TOWNSEND  
8:00-12:00. **Ophthalmology and Otolaryngology** Operative  
Clinic Selected Cases. WALTER R. CRATZ.

### Friday

8:00-12:00. **Genitourinary Surgery** Operative Clinic  
Selected Cases. FREDERICK A. BENNETT, CARL L.  
MULLENBARGER  
3:00-12:00. **Obstetrics and Gynecology** Operative Clinic  
Selected Cases. ALEX A. BLATERNICK, CARL E. KRUG-  
MEIER, ELTON W. TICE.  
8:00-12:00. **General Surgery** Operative Clinic Selected  
Cases. CLIFFORD O. BISHOP GEORGE R. DUNLEVY  
LEWIS F. ELLMORE, ADOLPH M. HANSEN ELMER A.  
NELSON ROY E. SIMPLEY JOSEPH A. PARKER, HAROLD  
P. TOTTEH  
8:00-12:00. **Hand Surgery** Operative Clinic  
Selected Cases. JOSEPH H. BOYES

## ORTHOPEAEDIC HOSPITAL, LOS ANGELES

### Monday

3:00-11:00. **Orthopedic Surgery** Operative Clinic Spinal  
Fusion for Scoliosis. JOSEPH CHARLES RUSHER.

### Wednesday

8:00-10:00. **Orthopedic Surgery** Operative Clinic. Fascial  
Transplants. CHARLES LOWMAN

### Thursday Morning

10:00-12:00. **Orthopedic Surgery** Nonoperative Clinic.  
Surgical Conference HAROLD E. CROWL.

### Every Afternoon

**Orthopedic Surgery** Nonoperative Clinic.  
PHYSICIANS AND SURGEONS HOSPITAL,  
GLENDALE

### Days not yet decided

8:30-12:00. **Gynecology** Operative Clinic Vaginal Plastic  
Procedures. HAROLD K. MARSHALL.

8:30-12:00. **General Surgery** Operative Clinic Two-Team  
Abdominoperineal Resection of Rectum. A. ELMER

8:30-12:00. **General Surgery** Operative Clinic Resection  
of Esophagus or Transthoracic Vagotomy

HAROLD LINCOLN THOMPSON

**Orthopedic Surgery** Nonoperative Clinic

Knee Surgery HUGH T. JONES.

**Orthopedic Surgery** Nonoperative Clinic

Surgical Treatment of Fractures—motion pictures.  
CHARLES W. GILFILLAN

**Orthopedic Surgery** Nonoperative Clinic

Internal Fixation of Fractures. JOSEPH WOLF

**Orthopedic Surgery** Nonoperative Clinic

Backache JOHN R. BLACK.

**Gynecology** Nonoperative Clinic

General Vaginal Prolapse HAROLD K. MARSHALL,  
DANSON TARR MATT STURDEVANT

## QUEEN OF ANGELS HOSPITAL, LOS ANGELES

### Tuesday

1:30-3:30. **Otorhinolaryngology** Operative Clinics  
Penetration Operation HOWARD P. HOUSE.  
Laryngectomy ALDEN MILLER.  
Nasopharyngeal Operation. JOSEPH GAYNOR.  
3:30-5:30. **Otorhinolaryngology** Nonoperative Clinics  
Illustrated Lecture on Acute Obstructive Laryngitis.  
ALDEN MILLER.  
Deafness in Children Treated by Radiation LAWRENCE  
K. GORDON.  
Sclerotic Mastoid and Its Roentgen Interpretation  
GILBERT R. OWEN

### Wednesday

8:00-11:00. **Obstetrics and Gynecology** Operative Clinics  
Total Hysterectomy FRANK F. SCHADE.  
Vaginal Hysterectomy SAMUEL MARTINS.  
Vaginal Plastic Operation for Correction Cystocele.  
Rectocele and Laceration of Pelvic Floor H. NIEBER  
GALL.  
Vaginal Plastic Operation for Correction of Stress In-  
continence of Urine (Kennedy Procedure) DANIEL R.  
MISHKELL.  
8:00-11:00. **General Surgery** Operative Clinics  
Diaphragmatic Hernia Thoracic Approach J. Norman  
O'NEILL.  
Gall Bladder ROBERT B. STEWART  
8:00-11:00. **Orthopedic Surgery** Operative Clinics  
Hemiarthrosis of Neck of Femur FRED ILFELD  
Meningeal Fracture of Neck of Femur JOSEPH PELUSO  
Arthroscopy for Benign Tumor JOSEPH PELUSO  
11:30-1:00. **Obstetrics and Gynecology** Nonoperative  
Clinics

Pregnancy Following Conservative Treatment for Pelvic  
Endometriosis. DANIEL R. MISHKELL and UMBERT E.  
AGE

Early Rupture of the Uterus Before the Onset of Labor  
A.M. MCCARTHY and C. V. VOW DER AHE.

Low Spinal Anesthesia in Obstetrics. A Report of 2,000  
Cases. FRANK F. SCHADE and WILLIAM CALDWELL.  
1:30-3:30. **Otorhinolaryngology** Nonoperative Clinic  
Discussion Frontal Sinus Operation. J. McKEITH

BROWN  
Lesion of the Floor of Mouth and Neck. COLBY HALL.  
Vaginal Repair of Injuries of the 7th Nerve FREDERICK  
VIOLE.

Correction of Septal Deformities. VICTOR GOODMILL.  
Foreign Bodies in the Esophagus and Respiratory Tract.  
SAMUEL JESSEN  
Malignancies of the Mastoid HAROLD BOYD.



Posthectomy of the Middle Ear. MAX PORTMAN

30-30. *Ophthalmology*. Operative Clinics

Strabismus. Demonstration of the O'Connor Clinch Operation and Recession of the Inferior Oblique Muscle. ALFRED ROBINSON

Cataract Extraction by the Castroviejo Section Technique. MAX RICK NUGENT

Combined Extractions. STEPHEN POROVICH

Glaucoma Decompression Operation. IRVING SCHWIM

30-30. *Ophthalmology*. Nonoperative Clinics

The Treatment of Corneal Scars by Beta Irradiation. WILLIAM H. BORN

The Tushy Corneal Lens. MAX RICK NUGENT

Complication Following Cataract Extractions. IRVING SCHWIM

The Scleral Shortening Operation for Detachment of the Retina. (Motion picture in color). W. F. BOWLER

Essential Hypertension and its Ophthalmoscopic Interpretations. STEPHEN POROVICH

#### Thursday

6:00-8:00. *General Surgery*. Operative Clinics

Thyroidectomy. WILLIAM U. SULLIVAN and TENERO D. CUNEO

Radical Mastectomy. DONALD E. ROSS

Abdominal Perineal Resection of Rectum. WILLIAM H. D. NELSON

Colon Surgery. JAMES L. WELLES and D. A. GAZZARD

8:00-10:00. *Orthopedic Surgery*. Operative Clinics

Intramedullary Fixing of Fracture. Anterior Approach to Elbow Joint. HENRY C. PIERCE and

Osteotomy and Union of Non-Union of Neck of Femur by New Reverse Nail. GALE H. HART

Subcutaneous Fasciotomy for Dupuytren's Traction. JAMES H. LUCK

30-30. *Orthopedic Surgery*. Nonoperative Clinics

End Results of Intramedullary Fixing of Fracture. ALFRED H. GALL

Slipped Upper Femoral Epiphysis. GALE H. HART

Subcutaneous Fasciotomy (Motion picture). JAMES H. LUCK

Reconstruction of Elbow. JAMES H. LUCK and C. PIERCE

#### Friday

8:00-10:00. *General Surgery*. Operative Clinics

Tricectomy for the Duodenal. ROBERT B. RANNEY

Gall Bladder Surgery. WALTER M. HOLLEY and

Carcinoma of Bladder. FRED RICK A. BEVETT

Partial Gastrectomy. JAMES F. REGA

Resection Carcinoma of Esophagus. FRANK S. DOLLEY and LYMAN A. BREWER

Retroperitoneal Prostatectomy. MORTON M. MAYERS

Thyroidectomy. DANIEL PORTMAN

30-30. *General Surgery*. Nonoperative Clinics

Radical Mastectomy (Motion picture in sound and color). DONALD E. ROSS

Mastopexy (Motion picture in color). JOSEPH GAYNON

Symphylarotomy (Motion picture). ROBERT B. RANNEY

Diabetes Mellitus Complicating Surgery. KENNEDY SMITH

#### ST JOHN'S HOSPITAL, SANTA MONICA

##### Monday

8:00-10:00. *General Surgery*. Operative Clinic. Surgery of the Gallbladder. ROBERT M. NEALE

8:00-10:00. *Gynecology and Gynecology*. Operative Clinic. Cesarean Section (Bicornuate Uterus). B. H. W. THOMAS

10:00-12:00. *General Surgery*. Operative Clinic. Surgery of the Colon. G. ARNOLD STEVE

1:00-3:00. *Orthopedic Surgery*. Operative Clinic. Laminectomy with Spinal Fusion. DONALD H. LINTVALL

#### Tuesday

8:00-10:00. *General Surgery*. Operative Clinic. Thyroidectomy. G. ARNOLD STEVE

8:00-10:00. *Gynecology and Gynecology*. Operative Clinic. Anterior and Posterior Colporrhinoplasty and Kell-Stitch. JAMES C. DOWLE and ALBERT C. MARRAS

10:00-12:00. *General Surgery*. Operative Clinic. Gastric Resection. MAX H. RABIN and DAVID H. ROSENBLUM

1:00-3:00. *Orthopedic Surgery*. Operative Clinic. Arthroscopy of the Knee. DONALD H. LINTVALL

#### Wednesday

8:00-10:00. *General Surgery*. Operative Clinic. Radical Mastectomy. JOHN F. KOWERS

8:00-10:00. *Gynecology and Gynecology*. Operative Clinic. Retroperitoneal Prostatectomy. GILBERT J. THOMAS and FRED C. SCHLESINGER

10:00-12:00. *General Surgery*. Operative Clinic. Vagotomy and Posterior Gastrectomy. FRANCIS L. HENRY and HENRY J. LANGE

1:00-3:00. *Plastic Surgery*. Operative Clinic. Rhinoplasty. JAMES J. PIERCE

#### Thursday

8:00-10:00. *General Surgery*. Operative Clinic. Herniorrhaphy (Tantalum Gauze and Tantalum Wire). MAX C. H. R. W. and DAVID H. ROSENBLUM

8:00-10:00. *Gynecology and Gynecology*. Operative Clinic. Total Hysterectomy. B. H. W. THOMAS

10:00-12:00. *General Surgery*. Operative Clinic. Melanoid Hemorrhaphy. FRANCIS F. BROWN and HENRY J. LANGE

1:00-3:00. *General Surgery*. Operative Clinic. Exploration of Common Duct. G. ARNOLD STEVE

Daily Pathological, nonoperative clinic. Rapid Method of Surgical Tissue Diagnosis. G. H. HUMMER

Daily Micro Laboratory nonoperative clinic. Photographic Aids. G. H. HUMMER

ST JOSEPH HOSPITAL, BURBANK

Days not yet decided

General Surgery. Operative Clinic. Selected cases.

ST LUKE HOSPITAL, PASADENA

Days not yet decided

Orthopedic Surgery. Nonoperative Clinic

Gynecology and Gynecology. Nonoperative Clinic

ST VINCENT'S HOSPITAL, LOS ANGELES

#### Tuesday

9:00-10:00. *Otolaryngology*. Operative Clinic. Selected cases. J. MACLEATH BROWN

9:00-10:00. *Ophthalmology*. Operative Clinic. Selected cases. A. KAY FINE

9:00-10:00. *General Surgery*. Operative Clinic. Thyroidectomy. WILLIAM F. KROGER

9:00-10:00. *General Surgery*. Operative Clinic. Selected cases. FRANK J. BREWSTER

9:00-10:00. *General Surgery*. Operative Clinic. Selected cases. FRANCIS E. BROWN and HENRY J. LANGE

9:00-10:00. *General Surgery*. Operative Clinic. Selected cases. JAMES MACDONALD and LEWIS W. CHASE

10:00-12:00. *General Surgery*. Nonoperative Clinic. Malignant Lesions of Colon. KAY FINE and S. D. VICK

1:00-3:00. *General Surgery*. Nonoperative Clinic. Surgery of Colon—motion pictures. WILLIAM H. D. NELSON

## CLINICAL CONGRESS, 1948

11:00- General Surgery Nonoperative Clinic Surgery of Esophagus—motion picture HAROLD LINCOLN THOMPSON

11:00-1:00. General Surgery Operative Clinic Selected cases CONRAD J. BAUMGARTNER.

11:00-1:00. General Surgery Operative Clinic Colon Surgery RALPH V. BYRNZ.

## Wednesday

9:00-12:00. Orthopedic Surgery Operative Clinic Selected cases. HUGH T. JONES JOHN R. BLACK.

9:00-12:00. Orthopedic Surgery Operative Clinic Selected cases. FRANCIS M. McKEEVER.

9:00-12:00. Neurosurgery Operative Clinic Selected cases. RUPERT B. RANNEY.

9:00-12:00. Neurosurgery Operative Clinic Selected cases. C. HUNTER SHILDEN.

9:00-12:00. Otolaryngology Operative Clinic Fenestration. HOWARD P. HOUVEL.

9:00-12:00. Ophthalmology Operative Clinic Selected cases. JOHN P. LORDAN.

9:00-12:00. Plastic Surgery Operative Clinic Selected cases. ARTHUR E. SMITH.

10:00- Tumor Surgery Nonoperative Clinic Thyroid Malignancy. HENRY J. LANGZ.

10:30- Tumor Surgery Nonoperative Clinic Struma Lymphomatosa and Fibrosis. ROBERT C. SURRIDGE.

11:00- General Surgery Nonoperative Clinic Obstructive Corrosive Gastritis. LOUIS C. BUCKNERT.

## Thursday

9:00-11:00. General Surgery Operative Clinic Selected cases. E. VINCENT ASKEY.

9:00- Otolaryngology Operative Clinic Selected cases. JOSEPH B. STREVER.

9:00-12:00. Gynecology Operative Clinic Selected cases. BERNARD J. HANLEY, JOHN C. McDEARMOTT.

9:00-12:00. Proctology Operative Clinic Surgery of Colon. WILLIAM H. DANIEL.

9:00-12:00. General Surgery Operative Clinic Vagus Neurectomy. EDWARD C. PALLETTE.

9:00-12:00. Ophthalmology Operative Clinic Selected cases. CLARENCE H. ALBAUGH.

10:00- Orthopedic Surgery Nonoperative Clinic Surgery of Hand. FRANK J. BREZLIN.

10:30- Orthopedic Surgery Nonoperative Clinic Surgery of Knee Joint. H. T. JONES J. R. BLACK.

11:00- Neurosurgery Nonoperative Clinic. Surgical Management of Intracranial Aneurysms—motion picture and lantern slide illustrations.

11:00-1:00. General Surgery Operative Clinic Selected cases. E. ERIC LARSON.

## Friday

9:00-11:00. General Surgery Operative Clinic Selected cases. LOUIS C. BENNETT.

9:00-11:00. Plastic Surgery Operative Clinic Selected cases. ARTHUR E. SMITH.

9:00-12:00. General Surgery Operative Clinic Selected cases. FRANCIS E. BROWNE, HENRY J. LANGZ.

9:00-12:00. General Surgery Operative Clinic Selected cases. WILLIAM P. KROGER, ROBERT C. SURRIDGE.

9:00-12:00. Gastrointestinal Surgery Operative Clinic Selected cases. ALBERT J. SCHILL, EDWARD CROWLEY.

10:00- General Surgery Nonoperative Clinic Trans-thoracic Vagus Neurectomy. E. C. PALLETTE.

10:30- General Surgery Nonoperative Clinic Car-rectomy of Spleen. RALPH V. BYRNZ.

11:00- General Surgery Nonoperative Clinic Carcinoma of Tongue, or Primary Mandibular Tumors. IAN MACDONALD LEWIS W. GUTH.

11:00-1:00. General Surgery Operative Clinic Selected cases. DAVID A. SCHMIDT.

SANTA FE COAST LINES HOSPITAL  
LOS ANGELES

## Monday

9:00-11:00. Genitourinary Surgery Operative Clinic Retropubic Prostatectomy. V. J. GALLAGHER.

9:00-10:00. Neurosurgery Nonoperative Clinic The Hemilateral Intervertebral Disc, Discussion of Multiple Herniations. HENRY M. CURRAN.

9:00-10:00. Otorhinolaryngology Nonoperative Clinic Allergy of the Nose and Paranasal Sinuses. GORDON J. McCURDY.

## THE SANTA MONICA HOSPITAL

## Thursday

9:00-11:00. General Surgery Nonoperative Clinics Traumatic Surgery. CHARLES A. LINDQUIST.

A New Method for the Movement of Fluids in the Extremities. J. P. SAMMONS and FREDERICK G. KIRBY.

Orthopedic Surgery Operative Clinic Reconstructive Orthoplasty of Congenitally Dislocated Hip. WILLIAM H. WRIGHT.

Demonstration Pre-ambulatory Diagram of Dislocated Hip. JOSEPH C. RISSER.

Contrast Orthogram of Dislocated Hip. RALPH MILLER.

U S ARMY MCCORNACK GENERAL  
HOSPITAL, PASADENA

## Friday

9:00-9:30. Genitourinary Surgery Nonoperative Clinic Amicrubic Urinary Infections. LYMAN STEWART.

9:30-10:00. General Surgery Nonoperative Clinic The Treatment of Regional Ileitis. GORDON K. SMITH.

10:00-10:30. Plastic Surgery Nonoperative Clinic Treatment of Facial Injuries. MONROE A. ROCH.

10:30-11:00. Orthopedic Surgery Nonoperative Clinic Treatment of Fracture of Forearm. VERNON J. LUCK.

11:00-11:30. General Surgery Nonoperative Clinic Hernia Repair Using Cooper's Ligament. LAWRENCE C. BALL.

## U S NAVAL HOSPITAL, LONG BEACH

## Day not yet decided

9:00-12:00. General Surgery Operative Clinics Gastrectomy. E. ERIC LARSON. Cholecystectomy. L. L. BEAN.

9:00-12:00. Genitourinary Surgery Operative Clinics Retro Public Prostatectomy. CARL F. RUSCHKE.

Varicocele. MILO ELLIS and L. A. NEWTON.

9:00-12:00. Orthopedic Surgery Operative Clinic Operation for Recurrent Dislocation of the Shoulder.

R. R. MYERS and JOHN M. ROWE.

9:00-12:00. Otorhinolaryngology Operative Clinic Rhinoplasty Using Cancellous Bone. E. KING ROBERT C. BOYDEN F. L. AMBLEY.

9:00-12:00. Neurosurgery Nonoperative Clinic Cerebral Aneurysm. ROBERT H. PUDENZ, CHAS. H. SHILDEN.

ARTHUR L. SCHULTZ.

9:00-12:00. Thoracic Surgery Nonoperative Clinic Carcinoma of the Lung. BEAT H. COTTON and V. C. STRATTON.

1:00-4:00. General Surgery Nonoperative Clinics Vaginal Rounds, Follow up on Vagus Resection and Gastric Resection. E. ERIC LARSON RALPH V. BYRNZ, WILLIAM E. DELPHEY CALVIN A. LAUER L. L. BEAN.

- 100-400 *Genitourinary Surgery* Nonoperative Clinic  
Post-operative Results from High Varioectomy CARL  
I. KUNCE, MILO LELAND, and L. A. NEWTON
- 100-400 *Otolaryngology* Nonoperative Clinic Motion  
Pictures. Nasal Bone Graft and Post-operative  
Results. L. KING, ROBERT C. BOYDICK, KENNETH C.  
BEADENBARK
- 00-400 *Neurosurgery* Operative Clinic  
Transfrontal Craniotomy or Cervical Disc. C. HUNTER  
SHALDO, ROBERT H. PUDAS, ARTHUR L. SCHULTZ
- 00-400 *Thoracic Surgery* Operative Clinic  
Pneumothorax. BY WILL COTTON and C. STRATTON
- 00-400 *Orthopedic Surgery* Nonoperative Clinic  
Ward Rounds, Post Operative Care of the Orthopedic  
Patient JOHN M. KOWE and R. R. MYERS, J. G.  
MANUEL

U. S. VETERANS ADMINISTRATION  
BIRMINGHAM GENERAL HOSPITAL, VAN NUYS

Wednesday

- 900-00 *Genitourinary Surgery* Nonoperative Clinics  
Results of Uretero-intestinal Implantation and Cystec-  
tomy for Carcinoma of Bladder DONALD C. MAL-  
COLL
- Thoracic Surgery* Operative Clinic  
Pulmonary Resection JOSEPH A. WERNER
- General Surgery* Operative Clinics  
Surgical Problems of the Paraplegic. ERNEST BOWLS  
Trans Abdominal Vagotomy and Gastrojejunostomy  
F. A. ALI II WILLIAMS
- Thoracotomy Sympathectomy by Intercostal Ap-  
proach THEODORE B. MAMMILL
- Neurosurgery* Operative Clinic Cervical Laminectomy for  
Myelogenic Disease JOHN D. FURVELL
- Otolaryngology* Operative Clinics Reconstructive Rhi-  
noplasty for Nasal Obstruction SAMUEL KAPLAN  
Endonasal Radical Mastoidectomy SAMUEL KAPLAN
- 000-300 *Orthopedic Surgery* Nonoperative Clinics  
Care of Traumatic Injuries of the Hand JOHN H. ALDER  
and JOSEPH H. BOYER
- Treatment of Bone and Joint T.B. with Streptomycin.  
JOHN H. ALDER

U. S. VETERANS ADMINISTRATION CENTER  
WADSWORTH GENERAL HOSPITAL, SANTELE

- 900-300 *General Surgery* Nonoperative Clinics  
Symptoms Tetra-ethyl ammonium Evaluation of P-  
peripheral Vascular Disease C. H. McINTYRE
- Results of Hydrolytic and Ascorbic Acid Treatment of  
Peripheral Vascular Disease. RUDOLPH WIDMANN and  
MILTON RINGOLD
- A New Method for the Movement of Fluids in the Es-

tremities. F. G. KIRBY and J. P. SAMPSON (Santa  
Monica Hospital)

- Orthopedic Surgery* Nonoperative Clinics.  
Symposium: Amputations in Peripheral Vascular Dis-  
ease. ROBERT MAZET
- General Surgery* Operative Clinic  
Lumbar Sympathectomy CHARLES S. KIPICK
- Anesthesia* Operative Clinic-Pain Clinic. CHARLES F. Mc-  
CLURE JR. ESTHER W. MOORE, and NEVILL H. ROY
- Ophthalmology and Otolaryngology* Nonoperative-  
900-900 Fundus Lesions with Pathological Sections and  
Microphotographic Slides. A. RAY JEVIER and CLAUDE  
S. MICHNER
- 900-00 Malignancies of Ear, Nose and Throat with  
Case Presentations. CLAUDE S. MICHNER and STAFF
- 00-300 Frenotomy Operation for Otorrhea with  
Case Presentations. CLAUDE S. MICHNER and STAFF

WHITE MEMORIAL HOSPITAL, LOS ANGELES

Tuesday

- 900-00 *Genitourinary Surgery* Operative Clinic  
Vesical D. erctectomy and Urethroplasty for Urinary  
Incontinence. ROGER W. BARKER, R. THEODORE  
BLOOM
- 900-00 *Orthopedic Surgery* Operative Clinic  
Surgical Treatment of Corns, Metatarsal Calluses, Ham-  
mer Toe and Bunions. ALONZO J. NEWFIELD and ASSO-  
CIATES
- 00-00 *Genitourinary Surgery* Operative Clinic  
Transurethral Prostatic Resections. ROGER W. BARKER,  
R. THEODORE BLOOM
- 00-00 *Genitourinary Surgery* Nonoperative Clinic  
Motion Picture Film—Transurethral Prostatic Resec-  
tion. Lecture Slide Demonstration. Round table dis-  
cussion. ROGER W. BARKER, Moderator

Wednesday

- 900-00 *General Surgery* Operative Clinic  
Total Excision of Parotid Gland with Preservation of  
Facial Nerve. CLARENCE E. NELSON and STAFF
- Obstetrics and Gynecology* Operative Clinics  
Vaginal Hysterectomy Low Cervical Cesarean Section.  
RALPH J. THOMPSON and STAFF

Thursday

- 900-00 *Proctology* Operative Clinics  
Team Abdominal Perineal Resection for Carcinoma  
of the Rectum. Ano-rectal Surgery (Selected Cases).  
MALCOLM R. HILL and ASSOCIATES
- Otolaryngology* Operative Clinics  
Frenotomy Rhinoplasty Endoscopic Clinic. BERTON  
N. COLVER and ASSOCIATES

October, 1948

**SURGERY**  
**GYNECOLOGY AND OBSTETRICS**  
*Supplement*

**INTERNATIONAL ABSTRACTS**  
**OF SURGERY**

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## COLLECTIVE REVIEW

### THE EVOLUTION AND CLASSIFICATION OF HERNIAL OPERATIONS

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MANY authors notably Marcy(53), Halsted(38) Raaf(62) Mastin and Andrews(3) have given us an excellent account of the early technical development of herniotomy. Other authors have added fragmentary but important historical data incidental to their main theme on hernia. However there has been no attempt to trace systematically the evolutionary steps in the development of the numerous operative procedures used in the repair of hernia since the acceptance of the fundamental principles for reinforcing the wall as originally proposed by Bassini (1887) and Halsted(38) (1893). In this interim of a half century the many variants in technique which have been introduced are legion. They are generally known by the names of the surgeons who devised them rather than by their distinguishing anatomical features. As a result of this practice, it has become burdensome to remember the numerous techniques and their modifications and to correlate them anatomically. In certain instances the same operation may be identified in America by the name of one surgeon and by that of another on the European Continent. The perpetuation of such a system of proper names, in appreciation and recognition of those to whom we owe so much in the development of hernial operations, constitutes a frequent source of confusion and misunderstanding.

Because of the delinquency in standardizing and classifying the various technical procedures there is lacking a common denominator for the

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discussion of the numerous methods of repair used in the radical cure of inguinal hernia. If an acceptable classification of hernial operations were available and the criteria for each were generally understood and sufficiently stressed there should be less indecision in choosing the operation that offers the greatest assurance of a cure of the type of hernia at hand. Consequently the greater our knowledge of herniology the more rational and selective will be our technique. To dispel the tendency toward adoption of a single technique for all hernias efforts should be directed toward the promotion of a better understanding of the genesis of hernia and to correlation of the fundamental principles underlying the repair of the varying structural deficiencies. For instance, illustrative of this evolutionary trend, the earlier authorities stressed the ablation of the sac as paramount others subsequently supported by the valid test of experience and familiar with concomitant parietal distortion were equally insistent on the necessity of strengthening the floor by repositioning of the cord a third group has laid much stress on the role of Cooper's ligament. The latter group recognized the value of previous surgical maneuvers but directed attention to the evaluation and correction jointly of the major underlying saccular or coexisting mural weakness. Because of these differing technological views and the lack of emphasis on criteria for their use, there still exists confusion in the mind of the junior surgeon whose training is our responsibility.

Therefore in order to clarify the existing confusion concerning the classification of a retinue of

hernial operations, we would like to propose three evolutionary periods of surgical development of hernial operations: (1) herniotomy (2) herniorrhaphy and (3) hernioplasty.

#### HERNIOTOMY

Generally, the term herniotomy is applied indiscriminately to any operative procedure which may be employed in the radical cure of inguinal hernia. It is frequently used in this stereotyped sense in compiling statistical data. However, herniotomy in its modern concept is understood to mean ligation and excision of the sac at the abdominal level of the internal ring without reinforcing the wall or displacing the cord. Therefore, in order to accurately define herniotomy it should be considered in relation to its evolutionary development as regards the level and methods of saccular obliteration. Consonant with this view, herniotomy is classified into (1) nonligation of the sac, kelotomy (2) low ligation of the sac, at the external ring (3) intermediate ligation of the sac, in the canal, and (4) high ligation of the sac, at the internal ring.

The sac may be obturated, obliterated or excised. Obturation of the internal ring was introduced by Macewen in 1886 which preceded Bassini's classic technique. The redundant portion of the sac is fashioned and positioned at the abdominal side of the ring, and the hiatus is plugged to prevent egress of the hernia. Unfortunately, but few surgeons were able to duplicate Macewen's results. The second method of saccular disposal is nonoperative: the sac is obliterated by agglutination of its contiguous surfaces. To accomplish this a local aseptic peritonitis, either mechanical or chemical, is produced following which apposition of the collapsed walls of the sac is maintained until synthesis occurs. This technique cannot be satisfactorily controlled; it is uncertain if its use is followed by many relapses, and it is practically impossible to totally obliterate the sac by this method. The ideal disposal of the sac is by ligation and total excision with resultant primary healing of the contacting serosal surfaces. It possesses the advantages of being perfectly controlled, is certain and safe, and is the method used exclusively in all modern operative procedures.

*Nonligation of the sac—kelotomy (Fig. 1a)* With the coming of the Renaissance, the mutilating and emasculating operations of the Dark Ages, in which the cord and testis were sacrificed, were abandoned and herniology of the heyday of the Greek civilization was revived. Early in the Sixteenth Century Pierre Franco was the first

surgeon with sufficient daring and courage to relieve strangulation by cutting the constricting ring which prevented its reduction. The technique of Franco's kelotomy was undertaken only as an emergency operation after taxis had failed. In that early period of hernial surgery the sole aim of the surgeon was life-saving. He discharged his responsibility in the treatment of hernia when the constriction had been released and the contents of the sac had been reduced.

*Low ligation of the sac—at external ring (Fig. 1b)* Impressive though the operation of kelotomy was when judged by the standards of that period, it was soon recognized that incising of the constricting band was only a temporizing measure. The remote results were very discouraging, as was shown by the appalling number of relapses. In retrospect, one could not expect the results to be otherwise as the sac was not obliterated nor was the wall repaired. To prevent the return of the hernia there was obviously need for technical improvement. Other contemporary methods proposed included (a) ligation of the cord and sac together with the use of a gold thread, as introduced by Bernard Metta (b) ligation of the sac alone exercising care in preserving the cord (first conceived by Gerardus of Metta, and subsequently employed in the middle of the same century by the illustrious Ambroise Paré) (c) exposure of the external ring and suturing the sac and pillars together. Socin, Czerny and Banks were the chief proponents of this method. Toward the latter part of the Seventeenth Century and the beginning of the Eighteenth Century many surgeons became convinced of the therapeutic value of surgery for incarcerated hernia. The greatest anatomists of that day Petit, Cooper, Richter, and Dieffenbach were staunch supporters of herniotomy.

The operation which gained the widest recognition in European countries and in America consisted of ligation of the sac at the external ring and suturing the pillars around the cord to reduce the size of the ring. Among those surgeons contributing much toward standardization of this operative procedure were Marcy (53) (1881) of Boston, who represented the consensus of American surgeons Steel (1874) of England, who occupied a similar position among his colleagues in the British Isles and Czerny (1877) who expressed the crystallized thought of the continental surgeons.

*Intermediate ligation of the sac—in the canal (Fig. 1c)* It was becoming increasingly apparent to the most experienced surgeons that the higher the obliteration of the sac the more successful the

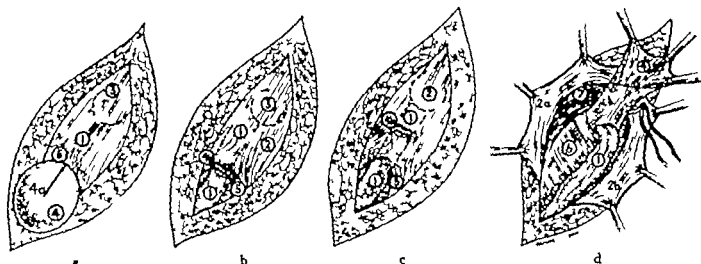


Fig 1. Herniotomy. Transsection of sac. Evolutionary steps in the progressively higher ligation of the sac.

a, Illustrates simple incision of the sac preparatory to reduction of the hernia (nonligation—kelotomy).

b, The sac has been mobilized and ligated at the level of the pillars of the external ring (low ligation).

c, The sac is occluded in the canal with transfixion of the stump to the margins of rent in external oblique aponeurosis. At this period of surgical development the aponeurosis had not been opened (intermediate ligation, in canal).

d, Portrays total excision of the sac at internal abdominal ring. To remove the sac at this level necessitates incising of the external oblique aponeurosis, which was first performed by Championniere in 1881 (high ligation at internal ring).

1, Spermatic cord 2, external oblique aponeurosis 2a, medial flap and 2b lateral flap 3, internal ring 4, hernial sac 4a, incision of sac and 4b, ligated sac stump 5, external ring 6, fascia transversalis and 7, internal oblique muscle.

operation as shown by the better end-results. The barrier to higher saccular ligation was the aponeurotic ring. Efforts to overcome this obstacle resulted in the proposal of various ingenious methods to attain this objective, such as twisting, plicating and positioning of the stump of the sac. Despite the handicap of poor exposure, attempts were made to ligate the sac in the canal a variable distance from the external ring. Ball (1884), Wood(81) (1885) Stoker (1887) and Bull (1890) twisted the mobilized sac which was either ligated in the canal, or the fundus was passed through a rent in the external aponeurosis and transfixed. MacEwen, McEwen and Barker conceived the idea of occluding the internal ring with a plug made from folding the sac and suturing it to the intra abdominal circumference of the internal ring. They further implemented the sacular occlusion by making taut the relaxed structures of the floor of the canal. These maneuvers were all done through the preternaturally enlarged external ring. The next innovation in hernia repair was made by Lucas Championniere (1881) who incised the external oblique aponeurosis which exposed the cord, the underlying mural structures, and the peritoneal sac to the level of the internal ring. By this simple stroke of deepening the incision, a new surgical and anatomical horizon was bared which was destined to be a milestone in hernial surgery.

*High ligation of the sac—at the internal ring* (Fig 1d). The technique of total excision of the

sac was evolved in the last quarter of the Nineteenth Century during which the modern concept of hernia repair originated. The principle of total excision was not long in receiving general acceptance. However there soon developed divergent views on the reparative methods of strengthening the floor of the canal.

In America, the operation that classically exemplifies herniotomy ligation of the sac at the internal ring without repair of the wall or disturbing the position of the cord is generally known as Ferguson's operation. Illustrative of the investigative spirit which prevailed at that time is the quotation of Ferguson: "A careful analysis of failures, a painstaking research for hidden truth and a discernment of contestable premises are ever before the surgeon who hopes for more success, new discoveries and lasting operative procedures. Out of an abundant surgical experience he proposed classification of the operative procedures for the correction of hernia into two types: typical and combined. The typical operation consisted of total excision of the sac only. The combined or late, Ferguson operation went one step farther to include tightening of the internal ring and taking up the slack in the fascia transversalis by suturing the conjoined tendon to Poupart's ligament all the way to the pubic spine. The latter operation was designed primarily to correct the weakness in the medial portion of the canal. Halsted(39) in 1903 added a slight variant by employing the cre-

master muscle to reinforce the posterior wall of the canal, but omitted tightening of the internal ring. Russell, too, has been a staunch advocate of the anatomical operation of Ferguson although his experience was confined largely to hernias in children.

Much controversy still exists regarding the merits of various operative procedures in the treatment of hernia, and whether to attempt to reproduce the equivalent, anatomically and physiologically of the inguinal canal. However if one accepts the modern concept of herniotomy this operative procedure should be given preference over other methods in the presence of the following criteria: (1) incipient indirect hernia (2) no dilatation of the internal abdominal ring and (3) no coexisting parietal weakness.

#### HERNIORRHAPHY

Herniorrhaphy is the second major evolutionary step in the progressive repair of inguinal hernia. It includes transposition of the cord and reinforcing the floor of the canal, additive to high ligation of the sac.

Available statistics following herniotomy revealed excellent results in some patients but there was also a substantial number of failures. The reason for the failures attracted the attention of many of the most experienced surgeons in America and Europe. Faulty execution of the technique of sacular ablation perhaps accounted for some of the recurrences, but obviously this was not an adequate explanation in others. The unfavorable results of herniotomy became so serious at one time that it was looked upon as a challenge to the surgical management of hernia, and particularly the principle of sacular ligation. Moreover it was becoming increasingly apparent that some essential was lacking in the operation such as a more selective application of sacular excision or a modification of the operative technique if a higher incidence of permanent cures were to be attained. Previously all hernias were considered indirect, and the existing mural weakness secondary to the dynamics of the expanding sac. Although Heister described direct hernia in 1724 there followed a long interim (three-fourths of a century) before the practical application of the knowledge of this important discovery. Direct hernia had not been looked upon as due primarily to deficiency of the internal oblique muscle and subsequent attenuation of fascia transversalis, an anomaly quite different anatomically and embryologically from that existing in indirect hernia. With the recognition generally of the basic differences of indirect and direct hernias, there came

changes in technique directed toward repair of the floor in the latter to conform to the newer anatomical and clinical knowledge. The means by which repair of the wall was achieved constitutes the second phase in the operative treatment of hernia. In reality herniorrhaphy was devised to take up the slack in the posterior fascial boundary for the treatment of direct hernia.

Although displacement of the cord is not an absolute prerequisite to strengthening of the floor nevertheless its transposition has played such an important role in the development of herniorrhaphy that it is inseparably associated with this era of hernial surgery. The brilliant and enduring work of Bassini, Halsted (38) Andrews (3) and others has had great influence on the attitude of the profession in adopting the principle of relocation of the cord. While there is still lack of unanimity in regard to its most strategic position, the consensus of most surgeons is decidedly on the side of funicular displacement. However it is only fair to state that mellowed opinions of our most experienced surgeons in the field of herniology view the disposition of the cord to implement the repair of the wall as having been overemphasized in the literature from the standpoint of therapeutic results. Nevertheless, it would seem that in the evolution of hernial surgery the most acceptable, practical, and logical classification of herniorrhaphy is the one based upon repositioning of the cord.

#### CLASSIFICATION OF HERNIORRHAPHY

1. Subaponeurotic, or placement of the cord under the external oblique aponeurosis—Marcy 1881; Bassini, 1884 and 1887.
  2. Extra-aponeurotic, or placement of the cord on the external oblique aponeurosis—Halsted, 1893.
  3. Interaponeurotic, or placement of the cord between the external oblique flaps—Andrews, 1895; Girard, 1901.
  4. Transfemoral, or placement of the cord in the femoral canal—Cheever 1903; Litsitsyn, 1934.
- Subaponeurotic position of the cord* (Marcy [53], 1881; Bassini 1884) (Fig. 2a) In that era of hernial surgery the acceptance of operative treatment for uncomplicated hernia was steadily gaining momentum and was rapidly reaching international recognition as the treatment of choice for all types of hernias. This was in distinct contrast to the prevailing attitude two decades previously when it was considered heresy to operate upon a patient with a hernia unless it was incarcerated or strangulated. The greatest restraint or obstacle to progress in hernial surgery at that

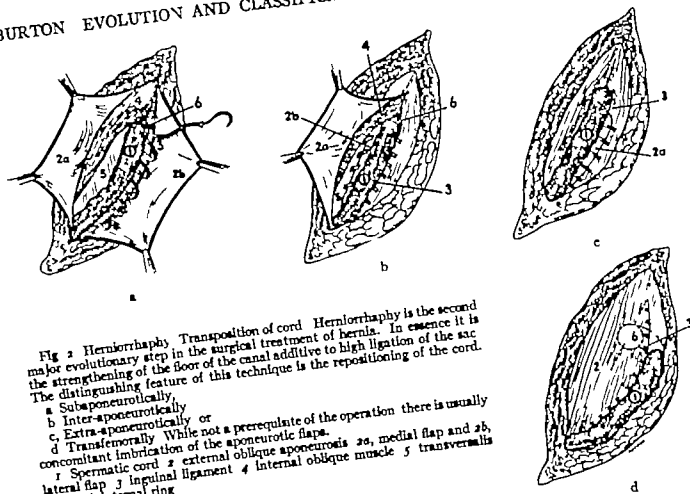


Fig 2 Herniorrhaphy. Transposition of cord. Herniorrhaphy is the second major evolutionary step in the surgical treatment of hernia. In essence it is the strengthening of the floor of the canal additive to high ligation of the sac. The distinguishing feature of this technique is the repositioning of the cord.

- a Subaponeurotically
  - b Inter-aponeurotically
  - c Extra-aponeurotically
  - d Transfemorally
- While not a prerequisite of the operation there is usually concomitant imbrication of the aponeurotic flaps.
- 1 Spermatic cord 2 external oblique aponeurosis 2a, medial flap and 2b, lateral flap 3 inguinal ligament 4 internal oblique muscle 5 transversalis fascia 6 internal ring

time was the high incidence of recurrence. In retrospect this apparent handicap to progress was in reality a blessing in disguise for it held in check unjustified enthusiasm and served to co-ordinate technical variants with advancement in anatomical knowledge.

The distinction of having been the first to transpose the cord in hernial repair has been accorded Marcy (1881) by Raaf (62) Andrews (3) and Joyce but, after reviewing Marcy's book, it would seem there is room for doubt as to the exact date of the initial performance of his operation. Three years later Bassini in 1884 through the application of knowledge gained from painstaking anatomical dissection of the inguinal region introduced an almost identical operation. The principle of Marcy and Bassini of relocating the cord was a radical departure from the previously existing conventional methods employed in the surgical treatment of hernia. The follow up results of Bassini's first series of 42 cases was so much better as compared to the results of other contemporary methods that most continental surgeons and subsequently surgeons of the United States adopted it as standard technique in the re-

pair of hernias. The Bassini principle (high ligation of the sac and reinforcing the floor of the canal by suturing the conjoined tendon to Poupart's ligament beneath the cord) has been more universally used than any other technique.

*Extra-aponeurotic position of the cord* (Halsted [38] 1893) (Fig 2c) Independently and almost simultaneously Halsted developed a repair similar to Bassini's except that the cord was placed on the external oblique aponeurosis. In addition he proposed minor technical modifications such as ligating the superficial veins of the cord to reduce its size and sectioning of fibers of the internal oblique and transversus abdominis to permit more lateral displacement of the internal abdominal ring. Halsted not only created a new canal by eliminating its obliquity but altered the relationship of the internal and external rings so that they were superimposed. In many of the larger surgical clinics the cord is still placed extra-aponeurotically but the collateral technical variants which he described have been abandoned.

In our series of 3,850 hernia repairs on patients mostly in the fifth and sixth decades, we have routinely placed the cord on the imbricated



aponeurotic flaps. Our opinion as regards this maneuver has not been altered by careful statistical studies of our results. If care is exercised in mobilizing and displacing the cord, if trauma is avoided by using sharp dissection and if the aponeurotic flaps are imbricated so as to cause no constriction of the cord as it passes through the external ring testicular atrophy is an exceptionally rare sequela. In most instances, testicular complications arise from excessive trauma or incomplete hemostasis in the freeing of the scrotal sac. In a series of 161 consecutive hernia repairs testicular atrophy occurred in only seven instances. It is generally agreed that the superficial position of the cord is not an objectionable feature because of its liability to trauma in laborious occupations. The parietal relationship of the cord does not affect its circulation or the testicular functions. The slitting perpendicularly of the lateral flap at the exit of the cord to avoid funicular constriction as proposed by Stetten in 1920 is now seldom done.

Theoretically the objective of the early Halsted procedure was an attempt at formation of a solidly fused trilaminar aponeurotic wall guarding the strategically weak points, i.e. the abdominal ring and the floor of the medial inguinal triangle.

*Interaponeurotic position of the cord* (Andrews [3] 1893, Girard, 1901) (fig 2b) The interaponeurotic relationship of the cord initially described by E. W. Andrews was a logical outgrowth of a wide surgical experience. He also overlapped the aponeurotic flaps however this feature of the repair had been employed by Lucas Championniere and Halsted. Andrews traveled extensively and had personally observed the technique of surgeons pre-eminent in this special field. At first he restricted his technique to those cases having a large gap in the fascial boundary of the floor of Hesselbach's triangle (direct hernia) but the results were so gratifying that it soon became the routine repair in his clinic. Andrews was aware of the principles of Bassini's repair in which the cord was placed subaponeurotically, and similarly knew that Halsted advocated the extra-aponeurotic relationship. He considered the funicular position of less importance than his contemporaries, and only incidental to the creation of a fundamentally sound wall. The primary purpose of this technique is to strengthen and guard the internal abdominal ring which is the gateway of indirect hernias. It was his contention that if sufficient tendinous barriers were placed at the internal ring it would prevent egress of the hernia. Andrews also insisted that the suturing of the internal oblique fibers to the inguinal ligament is unphysiological, further

distorts the musculature by interfering with its contractions, and actually predisposes to weakness of the abdominal wall in the medial angle of the canal. This observation of Andrews has been repeatedly confirmed and has played a significant role in the development of modern methods of repair.

For the sake of avoiding confusion, especially when referring to the literature of continental countries, it might be well to bear in mind that Girard of Switzerland described a technique similar to Andrews' interaponeurotic operation which postdated the latter by 6 years.

*Transfemoral position of the cord* (Cheever 1923) (fig 2d) The latest innovation in the positioning of the cord was proposed by Cheever in 1923 when he introduced a new departure in the radical cure of hernia. In this technique the inguinal and lacunar ligaments are sectioned at their attachments to the pubic bone until the femoral canal is opened. The cord is then placed in the femoral canal. With this transposition, the cord and external iliac vessels have a common exit and the femoral ring becomes the external inguinal ring. The inguinal and lacunar ligaments are then rejoined to the pubic bone. Whether the transfemoral position of the cord possesses any advantages over other long recognized transpositions in the inguinal canal can be seriously questioned. There are no confirmatory statistical reports available on the follow-up results of the transfemoral technique.

While herniorrhaphy was a forward step, possessing many advantages over herniotomy and has resulted in a decided lowering of the incidence of recurrences, nevertheless it has its shortcomings and limitations. Therefore in order for this technique to be most effectual, it should be restricted to the following criteria (1) indirect inguinal hernia with preternaturally large internal abdominal ring (2) laxity of the aponeurotic and fascial structures (3) indirect-direct or bilocular hernia and (4) normalcy of the inguinal ligament.

#### HERNIOPLASTY

Hernioplasty (herniofascioplasty) in a collective sense includes the more complex techniques used in hernia repair and is the third phase in the evolutionary development of hernial operations. It is the adoption of the principle of plastic reconstruction of the floor of the inguinal canal, usually with concomitant revision of the abdominal wall. The inguinal or iliopectineal (Cooper's) ligament, singly or combined, is utilized as anchorage for the medial parietal wall. In essence, it compounds our knowledge of hernia repair and

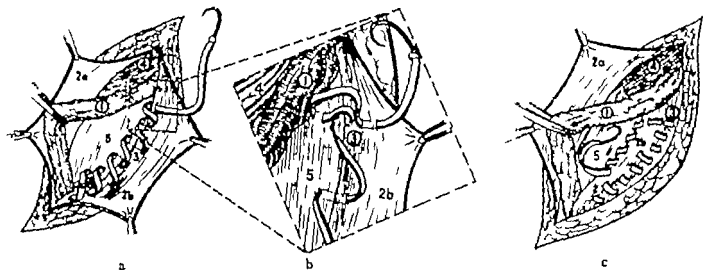


Fig 3. Inguinal ligament hernioplasty using a fascial suture. a, Illustrates the insertion of the first fascial suture which apposes the fascia transversalis to the recurved portion of the inguinal ligament. The suture first goes through the fascia transversalis, then through the recurved portion of the inguinal ligament beneath the pubic spine. It is returned and anchored by transfixion of its distal end. Notice that the needle passes from within outward, completely clearing the ligament. It is returned above, forming a vertical loop on the lateral margin of the inguinal ligament. Sutures are placed in this manner from the pubic spine to the level of the internal ring, completing the first layer of the reconstructed floor. It should be noted that the suture passes through the inguinal ligament at different vertical levels. This maneuver prevents longitudinal tearing of the ligament.

b, At the level of the internal ring the suture is so placed as to make a double on-end mattress suture. Placing of the suture in this manner creates an additional buttress at the inferior margin of the internal ring, a potentially vulnerable point in the floor. This feature in the placement of the suture at the internal ring is of greater significance when there is extra aponeurotic funicular displacement because in this arrangement the external and internal rings actually superimpose. This is done by reversing the transversalis bite. The needle is passed lateral to medial and moving on to the middle of the lateral aponeurotic flap at the same vertical level. This maneuver also pulls the lateral flap medially.

c, The suture is then continued, imbricating the lateral flap to the anterior surface of the fascia transversalis or rectus sheath. This completes the use of the first fascial suture and forms the second layer of the floor.

d, The medial aponeurotic flap is sutured over the lateral with the second fascial suture. The suture begins at the pubic spine and continues laterally to the level of the inter-



nal ring. This imbrication forms the third fascial layer of the floor. Notice this suture passes through the loops previously formed on the lateral margin of the inguinal ligament by the first fascial suture. This step is important as it obviates the necessity of the suture going through the inguinal ligament a second time. Consequently trauma to the ligament is minimized. This technical feature in the placement of the fascial suture has not been previously emphasized insofar as we have been able to determine in our review of the literature. The cord is now placed extra-aponeurotically. Beneath the cord there are three reinforcing fascial layers, held by two fascial sutures, an all-fascial closure.

1, Spermatoc cord 2a, medial flap 2b, external aponeurosis 2b lateral flap, external aponeurosis 3 inguinal ligament 4 internal oblique muscle 5 transversalis fascia.

is a bolder more aggressive attempt to overcome the manifold structural deficiencies or weaknesses that occur incidental to the progressive development of large hernias. It comprehends the use of fascial sutures, muscle, fascial or cutis grafts. If the donor structure is one of the strata in the operative field as in the McArthur technique in which a strip of external oblique aponeurosis is used as a suture, no additional skin incision is

required. However if the donor structure is remote to the inguina, it will necessitate the introduction of another usually small incision. The Gallie sutures from the fascia lata, the plantaris tendon of Pilcher, the Kirschner patch graft, and the Wangenstein pedicle graft are notable examples. This advance step of fascioplasty in the reconstructive repair of hernias opened up a broad field for the exercise of ingenuity on the part of

the surgeon in the selection and physiologic application of identical histologic or generically closely related tissues.

Therefore with this newly acquired phase of structural substitution it should be no surprise that the past quarter of a century has witnessed an unending procession of plastic maneuvers, all designed for the ultimate correction or cure of inguinal hernia.

Coincident with the development of the various plastic maneuvers, the idea of deeper anchorage of the parietal wall to the iliopectineal (Cooper's) ligament was revived. This basic departure in technique in which the inguinal and iliopectineal ligaments are placed in adjunctive and at times, competing roles, has resulted in the classification of hernioplasty as (1) inguinal ligament hernioplasty and (2) iliopectineal ligament hernioplasty.

#### INGUINAL LIGAMENT HERNIOPLASTY

Because of its accessibility and almost unvarying density, the inguinal ligament has long been employed for anchorage of the medial fascial boundary. For many years it was the only ligament used in hernia repair. So long as it retains its integrity there is no valid reason for altering this procedure, notwithstanding some recent changes in anatomical concept particularly in regard to the insertion of the fascia transversalis and internal oblique muscle. Herniorrhaphy presupposes a relaxed in contrast to a deficient floor but to slavishly follow this technique in all hernias and at the same time to neglect any indicated mural revision is illogical and will result in some avoidable recurrence. Consequently in those hernias presenting concomitant fascial deficiency of the floor of the canal, it is essential that the fascial stratum be replaced or reinforced before its ligamentous apposition. This should not imply that the antecedent removal of the peritoneal sac and definition of fascio-aponeurotic structures are not of foundational importance but it is intended to emphasize the value of the complementary plastic phase of the repair. The suitability and accessibility of like or generically related tissues forms the basis for the various technical departures and has led to the classification of inguinal ligament hernioplasty into (a) fascial sutures, (b) fascial grafts, (c) muscle grafts, and (d) cutis grafts. Heterogeneous sutures are excluded from consideration as not properly falling within the scope of this discussion.

**Fascial sutures.** The earliest and simplest departure from the conventional technique was the employment of a pedicled fascial suture, which was taken from the mesial cut edge of the external

aponeurosis but was left attached to the pubic spine. It was used as a running suture apposing the fascia transversalis to the inguinal ligament. This autogenous suture technique was devised by McArthur in 1901 almost a half century ago. Similarly double sutures from the same donor site have been employed by Robins, Sachs, Bigard, Guston and others. The technique was modified by Hodgkins, Le transversely raised pedicled strips of the rectus sheath are passed successively through the base of the medial aponeurotic flap, the adjacent fascial boundary of the canal, and the recurved portion of the inguinal ligament.

The pedicled suture possesses the advantage of not requiring an additional incision. Its disadvantages are the McArthur suture is relatively short and because of this will not permit darning or weaving a coexisting defect in the floor. Should the patient have a narrow external aponeurosis, it would shorten the suture proportionately with the result that it might not be long enough to reach the internal ring. The preparation and placement of the multiple interrupted sutures of Hodgkins are time-consuming and create considerable trauma.

The free fascia lata suture of Gallie and Le Mesurier is the most widely used autogenous suture. In the experience of many surgeons, Garner, Joyce, Masson, Masterson, Wangenstein, Burton and Ramos, it has resulted in the lowest recurrence rate in the group of recurrent or difficult hernias. The steps of the technique in the use of fascia lata sutures are illustrated in Figures 3a, 3b, 3c and 3d. The insert shows the strategic maneuvers of the suture in implementing the wall at vulnerable points. The living fascia suture in hernia repair has not escaped its critics but the dissenters are few. Burdick, Gillespie, David and Higginbotham, and Grace and Johnson, have criticized the fascial suture technique because of a higher incidence of recurrence and infections in their series.

The plantaris tendon has been employed by Pilcher but only one suture is available from each leg. There is agenesis of the muscle in 7 per cent of individuals, and the tendon is inadequate in size or strength in an additional 9 per cent (Daseler and Anson). These are serious drawbacks to its procurement. The ability of the tendon to fan out and span the space between the sutures is a property not possessed by fascial sutures. The heterologous or fascia of Koontz, Glaser and Egan can be preserved. It is therefore easily available (and another incision is avoided) yet more irritating, which is an objectionable feature. Chandy has shown experimentally that or fascia

may not completely disintegrate for as long as 5 years in some instances but, despite this, ox fascia has never gained wide acceptance in hernia repair.

**Fascial grafts** The three types of fascial grafts are pedicled, free and sliding. By reflecting the anterior rectus sheath lateralward and attaching it to the shelving portion of the inguinal ligament there is created an additional fascial stratum superimposing the canal. This hinged on-side pedicled graft was employed by Berger (1902), and by Halsted (39) (1903). Estes (1941) added another maneuver by suturing the lateral aponeurotic flap to the mesial cut edge of the rectus sheath. Small on-end grafts raised from the upper thigh subjacent to the inguinal region and pedicled near the inguinal ligament, have been described by Cowell (1927) and Turner (1933). Large on-end grafts of the iliotibial tract pedicled on the tensor fascia femoris muscle, have been employed by Ach (1910), Wangenstein (1932), Wilmoth (1937) and Burton and Ramos (1940). These large massive grafts are almost imperative where there exists a huge mural gap. The patch graft of Kirschner and of Singleton and Stehouwer in

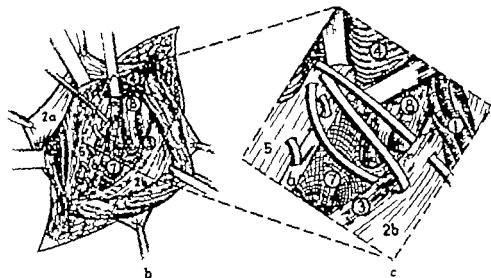
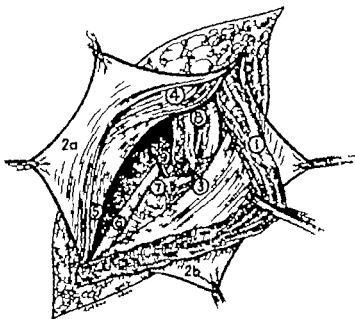


Fig. 4. Hernioplasty Iliopectineal ligament (Cooper's)  
a, The important anatomical structures of the inferior inguinal triangle and their relationship to the iliopectineal ligament are illustrated.

b, The first step of the repair is the insertion of the deep or first fascial suture. It begins posterior to the pubic spine and is directed laterally through the fascia transversalis and the iliopectineal (Cooper's) ligament. The suture is autotransferred and then progresses through the same structures to the level of the iliofemoral vessels. Although easily accessible medially, Cooper's ligament is quite deeply placed laterally. Care must be taken in the placement of the deep sutures in this ligament to avoid puncture or trauma to the external iliac vessels. We insert the index finger which protects and displaces these vessels lateralward during the placement of the last suture in the ligament. This lateral functional angle is a vulnerable area

and, in our experience, the most likely site of recurrence. It is therefore essential that the fascia transversalis be brought in contact with the major vessels in order to obliterate any chink. The suture is drawn taut, apposing the fascia transversalis to Cooper's ligament and incidentally excludes the femoral ring. A relief incision in the anterior rectus sheath as proposed by Fallis, Tanner and Rienhoff, may be necessary if there is undue tautness of the wall.

c, The suture is continued passing through the iliopectineal ligament, fascia transversalis and the inguinal ligament at the level of the iliofemoral vessels.

1, Spermatic cord 2a, medial flap, external aponeurosis 2b, lateral flap, external aponeurosis 3, inguinal ligament 4, internal oblique muscle, 5 transversalis fascia 6 iliopectineal ligament (Cooper's) 7 femoral ring 8 femoral artery and vein 9 obturator artery 10 rectus sheath incised

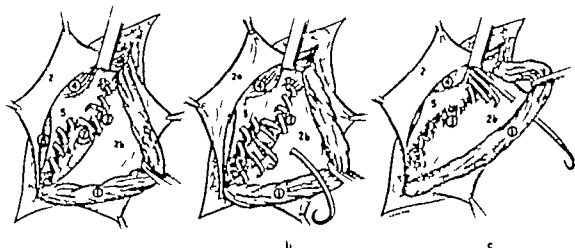


Fig. 5. Hernioplasty, Inguinal ligament (continued)

a. The suture continues through the medial parietal wall and the inguinal ligament to the internal inguinal ring. The transition of the suture through different mural and ligamentous levels is strategically important for it bridges the very widest point of the vulnerable interligamentous space.

b. Another potential weakness of the wall is inguinospectoral or interligamentous space which should be obliterated. This is the purpose of the second fascial suture. This suture passes through the first loop of the previous fascial suture going upward and from within out and pierces the inferior margin of the inguinal ligament. It returns, forming a loop on the lateral margin of the ligament. The process is repeated through the succeeding loops of the first fascial suture to the level of the iliofemoral

vessels. The idea of suturing the inguinal ligament to Cooper ligament as originally proposed by Roggi and later popularized by Moschcowitz.

c. The placement of the second fascial suture through the loop of the first suture further trammis to the iliopectineal (Cooper) ligament. This suture when drawn taut spaces and obliterates the interligamentous space and simultaneously closes the femoral ring. It also makes the inguinal ligament taut thus precluding herniation between the inguinal and iliopectineal ligaments which further adds to the structural security of the wall.

1. spermatic cord 2a. medial flap, external aponeurosis; b. lateral flap, external aponeurosis 3. inguinal ligament; 4. internal oblique muscle 5. transversalis fascia 6. iliopectineal ligament (Cooper) 7. femoral ring 8. rectus sheath incised.

which the fascia lata is the donor site, is easier to apply and less time-consuming but there is greater likelihood of its fibers tearing and the wall is less resistant.

A very valuable and simple maneuver and one gaining in favor has been described by Falls, and Tanner and Rlenhoff in which the rectus sheath is incised medially which allows separation of the fascia over the rectus fibers. In effect, it is a sliding fascial graft. Usually the relief incision will permit approximation of the cephalad fascial boundary of the canal to the shelf of the inguinal ligament without tension.

**Muscle grafts.** Another ingenious variant to implement the abdominal wall defect was devised by Bloodgood and Wölfer. They fanned out the lateral and inferior rectus fibers and sutured them deeply to the inguinal ligament. Because of the abnormal directional pull on the fibers with each contraction they did not remain for long in their displaced position. This repair was unphysiological and was soon abandoned. DeGarry sectioned the sartorius muscle and used one end to plug the femoral ring. This technique, too, was not suc-

cessful. To one familiar with the fate of redundant tissues, it is hard to convince oneself that the tampon remains for years just as it was at operation and even if not entirely absorbed, it is at least greatly reduced in size.

**Cutis grafts.** The latest plastic technique to be introduced in hernia repair is the dermal graft, which may be either full thickness, Thiersch, dermatome flap or split-split graft. Cannady and Mair report success with the use of transplanted dermal grafts nevertheless much skepticism exists regarding these grafts. During the patient's convalescence there is no support of the wall from this type of graft and potentially there is a greater likelihood of infection.

For the surgeon of limited experience and training in the repair of difficult hernias, and to add in the selective application of inguinal ligament hernioplasty, the following criteria may serve as a guide: (a) large indirect hernias with loss of obliquity of the canal (b) all direct hernias (c) indirect-direct hernias associated with attenuation of the fascia transversalis (d) most sliding hernias.

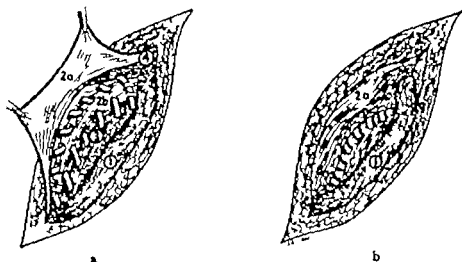


Fig 6 Hernioplasty Iliopectineal Ligament (continued) a, The remainder of the second fascial suture is returned, imbricating the lateral aponeurotic flap to the rectus sheath. By this imbrication the second fascial layer is formed. Up to this point in the progress of the repair, fascia is apposed to fascia by fascia, creating a double layer parietal floor. (Completion of second fascial suture) b, The medial flap is made to overlap the lateral. It is held in position by triple-0 silk which pass through the loop of the second autogenous suture. By planning the loops of the fascial suture and placing them with precision unnecessary trauma to the ligament is avoided. The cord is transposed extra-aponeurotically. (Completion of fascial flap imbrication)

1, Spermatic cord 2a, external oblique aponeurosis, medial flap 2b, lateral flap 3, inguinal ligament 4, internal oblique muscle

#### ILIOPECTINEAL LIGAMENT HERNIOPLASTY

In the presence of inadequacy of the inguinal ligament the surgeon is confronted with three alternatives (1) the substitution of the iliopectineal (Cooper's) ligament, (2) repair or stabilization of the inguinal ligament, and/or (3) its plastic reconstruction. The second and third procedures have largely been abandoned except as adjunctive procedures.

With the acceptance of the fundamental role of the iliopectineal ligament in certain types of anatomical weaknesses that occur in recurrent and difficult hernias, there have developed successively many corrective surgical procedures.

The three vulnerable areas which are constantly present and must be reckoned with in Cooper's ligament hernioplasty are (a) the femoral ring (b) the inguinopectineal or interligamentous space, and (c) the junctional space which is bounded by the iliopectineal ligament, iliofemoral vein, inguinal ligament, and medial edge of the parietal wall. The apex of this pyramidal space is located at the newly created external ring.

To overcome these potentially weak areas, iliopectineal hernioplasty may be divided into the following evolutionary technical variants (a) femoral hernioplasty (b) pectineal hernioplasty (c) inguinopectineal hernioplasty, and (d) combined inguinopectineal hernioplasty.

**Femoral Hernioplasty** Femoral herniation is simply a variant of the peritoneal sac which has made its exit through the femoral ring into the canal. Since the femoral ring is deep to the inguinal ligament, the usual inguinal ligament hernioplasty would not correct this hiatus. Formerly femoral hernias were approached from below the inguinal ligament however by this route it is not possible to totally remove the sac or to explore it to determine the presence of other saccular variants. It was in this type of hernia that Cooper proposed using the ligament which he described and which is named after him. Annandale (1876) has the distinction of having been the first to employ Cooper's ligament in the closure of the femoral ring by the inguinal approach. Others who have made valuable contributions to this technique include Auchincloss, Carscadden, and Payne. The femoral ring may be obliterated by suturing the inferior margin of the inguinal ligament to Cooper's ligament provided the former is lax. Should the inguinal ligament be taut, the ring may be spanned by weaving a fascial suture between the two ligaments.

**Pectineal hernioplasty** Additional etiological factors which should be recognized in the effective closure of the inguinal floor are inadequacy of the inguinal ligament and preternatural laxity of the parietal wall. The inguinal ligament may be so

attenuated or friable from previous trauma or infection that only a few strands remain, which prevents its use as an effective barrier to intra-abdominal pressure. To correct this ligamentous insufficiency it is necessary to either repair the ligament or substitute another. Experience has shown that the latter is the more practical and effective procedure. The iliopectineal superior pubic or Cooper's ligament is a very dense constant structure intimately related to the superior pubic ramus which is deep to and somewhat medial to the inguinal ligament. The employment of Cooper's ligament in lieu of the inguinal ligament dates back to 1809 when Lothsen, while operating on a recurrent hernia, discovered that the inguinal ligament was destroyed and he was confronted with the necessity of finding a structure for mooring the wall. He successfully substituted the former and he repeated this procedure in a series of 12 cases. This innovation in hernia repair was lost sight of for two decades before its revival in America by Scellig and Tuholske, Dixon and McVay. As the criteria for repair with the use of Cooper's ligament have been more clearly defined the technique has steadily gained wider acceptance. Silk may be used but we prefer a living suture for apposing the wall. The latter provides a broader contacting surface between the wall and ligament and it acts as a living graft bridging the lateral vulnerable angle. Autogenous fascial sutures are nonirritating and survive as long as 5 years. Figure 4b illustrates the placement of this suture which is the first step in the repair.

**Inguinopectineal hernioplasty.** The largest vulnerable space of the inguina lies between the inguinal and iliopectineal ligaments. The inferior margin of the inguinal ligament has no structural support except for the small, medial lacunar ligament and a thin, poorly defined band of connective tissue of little retentive value lateral and superjacent to the iliofemoral vessels. Consequently the stability of the inguinal ligament depends almost exclusively on its tautness between its points of origin and insertion. Since the inguinal ligament is a continuation and reflection of the external aponeurosis it is subject to the same factors which predispose to weakness of the abdominal wall. Moreover it is conceivable that the greater the pull cephalad on the external aponeurosis, particularly if there is concomitant intrapelvic pressure, the greater the likelihood of widening of the interligamentous space. Consequently as vulnerability of the interligamentous space has become more evident attention has been focused on measures designed to reinforce or

exclude it, preferably the latter by altering the ellipsoidal contour of the floor of the inguina by attaching the medial fascial boundary to Cooper's ligament. Ruggi (1898) first proposed obliteration of this space but this variant received scant attention until popularized by Moschowitz. Ruggi and Moschowitz used silk which is very satisfactory if the ligaments can be apposed, but if the inguinal ligament is taut its use will simply result in the sutures cutting through the ligament, which will revert to its former position. The other alternative is the obliteration of this space by weaving a living fascial suture between the two ligaments which not only affords stability but serves as a graft by spanning this space (Fig. 5b). It should be recalled that Moschowitz envisioned this technical step of pectinealizing the inguinal ligament which he introduced as adjunctive to inguinal ligament hernioplasty and not as we think of it presently as one of the departures of Cooper's ligament repair.

**Combined inguinopectineal hernioplasty.** The preceding modifications in technique in the use of Cooper's ligament which are described, are all progressive steps and each step was designed to reinforce or exclude an anatomical weakness—muscular, ligamentous or interligamentous so, it is only logical in our quest for a better operation, to project a composite technique which would embody the important surgical features of each into one integrated procedure. For instance in the first technical variant attention was focused on removal of the sac and closure of the femoral ring; in the second, the interligamentous space and femoral ring were excluded; the third was primarily the closure of the interligamentous space and the fourth, as the name implies, is a combination of the pectineal and inguinopectineal variants into one integrated procedure by employing two fascial sutures. The first fascial suture anchors the parietal wall to the iliopectineal ligament and continues lateralward and upward from the transitional angle apposing the wall to the inguinal ligament (Fig. 4c). To further implement the wall a second fascial suture bridges the space between the inguinal and iliopectineal ligaments (Fig. 5b). While the latter may not always be essential in the prevention of a recurrence it certainly augments the inguinal ligament and provides the ultimate in preventing the development of minute or potential weaknesses. The details of the combined technique are described more fully with the illustrations. With increasing experience in the repair of Cooper's ligament we find ourselves using the composite procedure almost to the exclusion of the other variants.

The criteria which should be present before considering repair of the iliopectineal (Cooper's) ligament are

- |   |                       |
|---|-----------------------|
| (a) All femoral loculations of the sac      | absolute indications  |
| (b) Inadequacy of the inguinal ligament     |                       |
| (c) Arbonization of the sac                 | equivocal indications |
| (d) Generalized laxity of the inguinal wall |                       |
| (e) Widening interligamentous space         |                       |
| (f) Refractory hernias                      |                       |

#### SUMMARY

1 A classification of hernial operations based upon evolutionary phases of their development in keeping with the modern concept of hernia repair has been presented

2 The criteria for each basic repair have been outlined

3 The anatomically weak areas, the medial angle of the floor and the internal ring in the superior inguinal region and the femoral ring, interligamentous space and the lateral transitional or junctional angle in the inferior inguinal triangle, have been correlated in the application of the various techniques

4. The inguinal ligament repair has been contrasted with the iliopectineal ligament three-dimensional repair

5 The vulnerability of the inguinopectineal (interligamentous) space has been emphasized with proposal of technical maneuvers for its reinforcement or exclusion

6 We concur in the previously expressed opinion of Fallis that the real cause of recurrence lies in a technical error at the primary operation, for if the factors predisposing to recurrence had been recognized then and adequate steps taken to circumvent them the first operation would have been as satisfactory as the last.

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selection on entering the industry and even if this was possible it would seem unwise to exclude from the mines a body of men who would give many years of satisfactory service before breakdown.

JAMES E. LERENBORN M.D.

**Binocular Vision in Miners.** DOROTHY ADAMS CAMPBELL, RUSSELL HARRISON, and JEAN VERTIGEM. *Brit J Ophth* 94:8 3 6

The binocular vision of miners with nystagmus was compared to that in other coal miners and in normal controls in the various age groups. Each subject was tested for stereoscopic vision, fusion, duction and simultaneous perception in both light and dark adaptation. In all of the eyes examined the subject's angle tended to become convergent when dark adapted but this response was less in those with miners nystagmus. The majority of miners fixated abnormally with the eyes looking somewhat upwards.

An incidence of about 10 per cent poor stereoscopic vision occurred in the controls, and tended to increase with age and under dark adaptation. This variation was greater in miners and most marked those suffering from nystagmus. The power of adduction in the control subjects did not vary with illumination or with their stereoscopic efficiency but in all the miners with good stereoscopic vision adduction was overdeveloped and in those with poor stereoscopic vision adduction was almost nil.

A breakdown in binocular vision occurs under conditions of low illumination. In the early stages of miners nystagmus the nystagmus is usually vertical and may be unilateral. In the intermediate stage of bilateral nystagmus, any attempt at macula fixation results in macular suppression, though some degree of fusion, duction and stereoscopic vision is present. In cases of long standing in patients who have been off work for a long period no nystagmus can be elicited, but the outstanding features—photophobia, blepharospasm, and psychoneurosis—prevent any evaluation of binocular function at this stage.

JAMES E. LERENBORN M.D.

**Preglaucoma.** SANDERS K. STROUD. *Trans J M* 94:8, 43, 690.

This article deals with a syndrome called preglaucoma which is a difficult condition to diagnose because of its vague and elusive subjective symptoms and objective findings.

The subjective symptoms are (1) mild or severe headaches, occipital, ocular and down the neck, the pain usually being worse at night (2) drowsiness to a pathological degree (3) lachrimation (4) discomfort with refractive correction and (5) decreased accommodation.

These symptoms were found in any age group, with any type of refraction, in all races, and in all physical types.

Objective findings are almost absent and tension is normal. Frequently the eyes are irritable and become inflamed on manipulation. Vision may be

slightly below normal. The visual fields are normal but there may be a slight enlargement of the blind spot. Repeated tonometer readings may show a slight difference of from 5 to 10 points between the two eyes. Also the variation of tension before and after (a) the administration of mydriatics, (b) a visit to the movie theater (c) coffee drinking, should be observed as well as morning and evening variation. Any variation of five points is suggestive. Any of the above findings should lead to a therapeutic test of mild miotics which should relieve symptoms.

The relationship of this condition to glaucoma is not clear. Many patients never develop glaucoma even without treatment, and of those who do, some develop the acute uncompensated form and others the chronic compensated variety.

EARL H. MEEL, M.D.

**Glaucoma following Cataract Extraction.** WILLIAM COCKLEMAN OWENS. *South M J* 94:8, 4 157

This article deals with the postoperative occurrence of glaucoma in 2,086 cataract extractions at Wilmer Institute during the period between 1925 and 1943.

In this group the overall incidence of postoperative glaucoma, including all methods of cataract extraction was 4.2 per cent. The incidence of glaucoma in the group of intracapsular extractions with corneoscleral sutures in patients with normal pupils was 6 per cent.

Glaucoma following cataract extraction is almost always secondary to some complication that has occurred during the course of the operation. The complications that most frequently predispose to secondary glaucoma are (1) postoperative iridocyclitis resulting from retention of lens material or loss of vitreous (2) poor closure of the wound with delayed or nonreformation of the anterior chamber (3) incarceration of iris vitreous, or capsular material in the incision (4) epithelial downgrowth (5) inadequate communication between the posterior and the anterior chamber.

These complications are the predecessors of postoperative glaucoma and can usually be avoided by certain operative techniques. The operation should be performed under adequate anesthesia. The speculum should cause no pressure on the globe. A conjunctival flap and corneoscleral sutures should be used to promote firm closure of the wound and rapid formation of the anterior chamber. A round pupil should be preserved but an adequate peripheral iridectomy or iridectomy should be made. The lens should be removed in its capsule if possible but if the capsule ruptures, the eye should be cleared of as much lens material as possible. Lastly the wound should be carefully inspected and freed of any incarcerated vitreous, capsule or iris tissue.

The treatment of this type of glaucoma varies with the condition. If tension is due to iridocyclitis it is best to use mydriatics and nonspecific protein therapy. If a sensitivity to lens protein can be demonstrated, desensitization is in order. If surgery

must be resorted to in the presence of active iridocyclitis in an aphakic eye a corneoscleral trephine is the operation of choice

In most cases all signs of active iridocyclitis have disappeared before tension becomes elevated. In these miotics are used

In cases of mechanical block between posterior and anterior chamber a transfixation operation will prove of value.

When the anterior chamber angle is blocked a cyclodialysis is the operation of choice

EAL H. MEER, M.D.

**Orbital Restoration with Buccal Mucosa** JAMES N. GREER, JR. *Am J Ophth* 1948 31 445

The author introduces the subject of orbital restoration with buccal mucosa by reviewing the attempts at socket restoration in early days. The first world war gave great impetus to this procedure and World War II with its orbital injuries has provided ample opportunity for further study

Mucous membrane of the mouth was used because it is easily accessible clean free from odor and its removal leaves no residual deformity at the donor site. There is sufficient mucous membrane in the mouth for complete restoration of the orbit. The procedure is outlined as follows

Preoperative procedure The operative field must be free from infection and well healed.

Anesthesia. Either local or general anesthesia is satisfactory. If general anesthesia is decided upon intratracheal intubation is used

Preparation The area is well cleansed with soap and water and a 1 to 5000 aqueous solution of zephiran on gauze is used as a mouth pack. The pack remains until dissection of the socket is completed.

Preparation of the bed to receive the graft is carried out according to Wheeler's technique. The plane of dissection is superficial and the dissection is carried to a point beyond the orbital margin—below and temporally. Nasally it extends to the orbital crest of the lacrimal groove and to the orbital margin beyond. The caruncle must be preserved if possible. Bleeding must be completely controlled. All scar tissue and granulation tissue must be excised

The graft is removed from the buccal surface after infiltration of 1 per cent novocaine and Stenson's duct must be preserved. Trauma must be minimal. All submucous tissue is then excised from the graft. All submucous tissue is closed with mattress sutures and the buccal wound is sutured into its new bed of heavy silk. The graft is sutured into its new bed with interrupted No. 6-0 black silk sutures. Three or four 4-0 sutures are threaded through rubber tubing and through the graft in depth of new fornix and are passed through periosteum above and below to anchor them. The socket is then packed with ¼ inch vaseline gauze.

Postoperative procedure. The first dressing is allowed to remain for 5 to 7 days, and firm packing is applied then dressings are changed every 3 days for 2 weeks or until the graft is well healed

EAL H. MEER, M.D.

**Management of the Wound behind the Ear following Mastoidectomy** (Behandlung der Wunde hinter dem Ohr nach Aufmeisselung des Warzenfortsatzes—Mastoidektomie) TH. HUEDELMANN *Dtsch. med. Wochenschr.* 1948 73 18.

The author traces the evolution of management of the wound behind the ear following mastoidectomy. Formerly the antrotomy wound was left wide open and packed with a tamponade which was changed frequently. Wound healing was painful, required 6 to 8 weeks and resulted in a deep depressed scar. Attempts at primary suture were often followed by dangerous complications. Partial closure with iodoform gauze drainage strips and compression dressings shortened the healing time.

The author believes that scar abscesses and retroauricular fistulas are results of an incomplete operation. His experiences with primary suture have led to the following conclusions

This is the method of choice when used in conjunction with sulfonamides for primary closure is careful and complete removal of all cells. The wound cavity should be filled with sulfonamide powder and in the first 3 days after operation sulfathiazole should be administered. The desirability of the method lies in the shortening and simplifying of the postoperative care and the freedom from pain during the healing period. JOHN L. LUNDQUIST, M.D.

**The Fenestration Operation A Survey of 560 Cases.** HOWARD P. HOUSE. *Ann. Otol. Rhinol.*, 1948, 57 41

The author gives a survey of 560 fenestration operations for otosclerosis, all of which were done more than 6 months previously and attempts to answer from the results obtained three questions which the patient asks regarding the operation. These questions are—

1. Am I a suitable subject for surgery?
2. What are the possible complications of such a procedure?
3. What results may I expect following the fenestration operation?

The author gives a brief discussion of the operation and postoperative care. He uses a slight modification of the original Lempert novovalis technique. The cartilage stopple, the gold burr and the more recent lead burr technique were not used in this group.

Indications for fenestration surgery. A patient with a progressive conduction type of hearing loss with intact ear drums and patent eustachian tubes is suitable for operation provided he does not have serviceable hearing, his general health must be good, and he should have good cochlear nerve function. Previous ear infection or even mastoid surgery does not contraindicate fenestration provided the ear drum is intact.

Patients more than 60 years of age should rarely be operated on. If such patients have good nerve

function they will hear well with a hearing aid for the remainder of their lives.

The determination of cochlear nerve function is very unsatisfactory and better methods of determining this function will have to be developed. However, determinations made with bone conduction audiograms and tuning forks have been reasonably effective.

The author divides the patients into three classes:  
1. In the ideal case the cochlear nerve loss does not exceed 10 decibels in the speech frequencies.

2. In the borderline case the cochlear nerve loss must not exceed 20 decibels in the 512 and 1,024 frequencies, and must not be greater than 30 decibels at the 2,048 level.

3. Any patient having a cochlear nerve loss below the borderline group is generally considered to be unsuitable for surgery.

Rarely however one is justified in operating on a so-called nonsuitable case, particularly that of a young individual with a rapid loss of both air and cochlear nerve function as the operation at times will prevent further nerve deterioration.

The poorer ear is usually selected for operation but in some cases the patient has found out that the hearing aid is more effective in the poorer ear and then the operation may be advisable on the better ear. Often, if tinnitus is less noticeable in the poorer ear it may be advisable to operate on the better one. With normal hearing in one ear there is no justification for operation on the opposite otosclerotic ear. It may be justified in rare cases in which unbearable tinnitus is present in the otosclerotic ear.

Surgery is not contraindicated during early pregnancy if the patient with otosclerosis gives a history of hearing loss during a previous pregnancy. An operation then may have a chance of preventing further hearing loss. The advisability of terminating pregnancy arises in patients with otosclerosis exhibiting a marked cochlear nerve loss, which is not suitable for operation. The ultimate decision must rest with the patient.

Aural discharge was bothersome in some 20 per cent of the cases. This drainage may be intermittent or continuous and at times becomes secondarily infected. This complication has become less frequent in patients more recently operated on because of the technique of creating a smaller mastoid cavity which allows epithelization to occur more rapidly.

Results obtained by fenestration. Eighty-five per cent of the 500 patients in this series complained of preoperative tinnitus. 34 per cent of these were completely relieved and an additional 54 per cent were partially relieved of this complaint.

The improvement in hearing is shown in the following table:

#### HEARING RESULTS OF ALL OPERATED CASES

	N	Per cent
Serviceable hearing	351	70+
Improved hearing but nonserviceable	86	17
Unchanged	44	9
Closure of fenestra	39	8
Air conduction worse than preoperatively	9	4
Bone conduction worse than preoperatively	5	

In this series of 500 cases, 8 per cent of the patients lost their initial hearing gain because of closure of the fenestra within the first 6 months. An additional 3 per cent closed during the second 6 months. To date the author has observed no closure in any patient after the first year. Therefore, after one year more than 66 per cent of all patients in this series have maintained serviceable hearing.

Closure of the fenestra usually occurs the third or fourth month following surgery. When closure occurs in one ear, it does not indicate that closure would occur in the opposite ear also if that ear were operated on. The second ear should not be operated on if the hearing did not reach the serviceable level in the first ear immediately following the operation, unless the patient is able to hear well in the ear originally operated upon.

# SURGERY OF THE HEAD AND NECK

microscopic findings. With proper treatment the prognosis is excellent.

In the present series the lesion occurred chiefly in the aged the average age being 67 years. Tobacco chewing was thought to be a most important etiologic factor. The predominant sites of the lesion were on the buccal mucosa and lower gingiva a tendency to invade contiguous structures was the rule but no evidence of distant metastasis was found in any of the 31 patients whose cases were studied. Local metastasis too was rare although the concomitant infection frequently caused enlargement and tenderness of the regional lymph nodes which often leads to an erroneous diagnosis of metastatic carcinoma from a papillary carcinoma.

Grossly the papillary lesions present a somewhat pebbly mammillated surface pitted up in rugal folds with deep cleftlike spaces between them. Microscopically the lesion begins with a piling up of keratin on the surface and a beginning downgrowth of fingers of epithelium. With progression, club-shaped fingers of a hyperplastic, well differentiated epithelium with an intact basement membrane gradually push their way into the deeper tissues, eventually producing deep cleftlike spaces of degenerating keratin and cystic degeneration of the deep central portion of the fingers. Beyond the progressing lesion is a wall of inflammatory tissue.

In the treatment of verrucous carcinoma of the oral cavity the treatment of choice depends on the extent of the lesion. For small superficial lesions it is believed that roentgen irradiation is apparently successful. Seven patients were so treated with recurrence in only 1 patient after a period of 43 months 4 others are living without recurrence after periods varying from 41 to 86 months. Two patients in this group died of intercurrent infection.

Seven other patients also received radiation therapy which was followed by surgical excision of the recurrence. Of these 3 have died of other diseases and 4 are living without further recurrence after periods varying from 6 to 60 months.

Local excision alone was the method of choice in 9 cases. One patient in this group died of intercurrent disease and one had a recurrence after 24 months. The rest are living without recurrence after periods varying from 4 to 36 months.

In 8 cases, excision plus mandibular resection and upper neck dissection was performed as the primary treatment. There was no recurrence in 7 patients after periods varying from 14 to 49 months one patient died of intercurrent disease.

In summary of 14 patients treated by irradiation, 8 had recurrences whereas of 17 patients treated primarily by surgery only 1 had a recurrence.

EUGENE L. DELLACKI, M.D.

## PHARYNX

The Pediatric Approach to Tonsillectomy J. AUBSON  
GLOVER. *Arch. Dis. Child.*, Lond. 1948 23 1

The author states that in England and Wales the incidence of tonsillectomies in the last 45 to 50 years

has mounted from almost 0 to some 200,000 a year. Tonsillectomies are done more than three times as frequently among the children of the well-to-do as among the children who attend public elementary schools and varied from 0.1 to 5.0 per cent among all children in average attendance at the public schools from 1936 to 1938 in 19 Kent educational areas. The highest incidence occurs between the ages of 5 and 7 years with a peak at the age of 6.

If the tonsil has a function of absorbing small numbers of organisms and so establishing immunity, by gradual dosage (Griffith, 1937) this is the time when it is most likely to be useful and when enlargement might be expected and might even be beneficial.

The indications for tonsillectomy are divided into two groups the objective based on the size and appearance of the tonsils, and the indirect for the prophylactic and curative effect of the operation. The author believes that physicians do not consider size alone as of clinical importance unless true obstruction occurs. However great difference of opinion exists as to the appearance of infected tonsils and removal on the basis of appearance offers a difficult decision. It is obvious that when the probable purpose of the intervention is to arrest the invading organisms the tonsil must be infected.

The author believes that frequently repeated attacks of acute tonsillitis, recurrent quinsy, or both are the most reliable indirect indications for tonsillectomy. He regards frequent colds as a symptom of sinusitis rather than as an indication for tonsillectomy and believes that sinusitis is a cause of tonsillitis. He believes that medically "bronchitis" is considered a contraindication to tonsillectomy and states that no beneficial effect on asthma and allergic states has resulted from tonsillectomy. Medical opinion is divided as to whether enlarged cervical glands constitute a proper indication but no conclusive evidence to date has been found to indicate that tonsillectomy greatly lowers the incidence of otitis media. Nephritis which in the past has been considered one of the more important indications for the removal of diseased tonsils, does not, in the author's opinion, constitute an adequate indication. He holds the same opinion with regard to acute rheumatism and carditis.

He believes the operation is never urgent and should be preceded by a period of observation of 6 months, after the completion of any necessary treatment of the teeth and sinuses.

JOHN J. BALLINGER, M.D.

## NECK

Propylthiouracil: Its Use in the Preoperative Treatment of Severe and Complicated Hyperthyroidism. ELMER C. BARTZEL. *West J. Surg.* 1948 56 216.

The author presents a series of 300 patients with moderate to severe hyperthyroidism treated with propylthiouracil. Propylthiouracil was found uniformly effective in reducing the basal metabolic rate

when given in the daily dose of 500 mgm. for primary hyperthyroidism and 300 mgm. for adenomatous goiter with hyperthyroidism.

Toxic manifestations occurred in 6 cases. One of these had a fever reaction, 5 had depressive changes in the white blood cells, and one had agranulocytosis.

The author now combines Lugol's solution with propylthiouracil from the beginning of treatment in cases of primary hyperthyroidism, because he thinks the quick action of Lugol's solution produces more prompt subjective improvement although it does produce some delay in return of the basal rate to normal. No death occurred in the series following thyroidectomy. W. FOSTER MONTGOMERY, M.D.

**Studies on Thyrotoxicosis.** JAMES HARRIS. *West. J. Surg.* 94, 56-59.

The author classifies thyrotoxicosis as primary and secondary. The primary types comprise the forms due to hyperplastic processes in the gland, namely exophthalmic goiter and conglomerate goiter. The secondary types of thyrotoxicosis comprise those occurring in a gland not otherwise thyrotoxic. This includes neoplastic processes, adenomas, papilliferous tumors and carcinomas, further inflammatory processes, and thyrotoxicoses induced by iodine or roentgen treatment.

With regard to the pathological picture of thyrotoxicosis, the author classifies the microfollicular mass and proliferation of epithelium as type 1 and the macrofollicular proliferation with the big winding follicles and the papilliferous excrescences as type 2.

Cardiovascular symptoms, circulatory dynamics, and the preoperative treatment are discussed.

It is believed that the importance of radical operation cannot be overestimated. A table is presented

to show the serious risk that is involved in the reoperation. W. FOSTER MONTGOMERY, M.D.

**Malignant Tumors of the Thyroid Gland.** BARTON McSWAIN and WALTER DIXELEY. *Surgery* 94, 57-58.

The authors report a small series, 23 cases, of malignant tumors of the thyroid gland in order to point out the fact that such lesions are uncommon in general hospitals outside of the goiter belt and to emphasize some points in their clinical manifestations, microscopic characteristics, and treatment. The authors place the tumors in their series in one of seven classifications: (1) papillary adenocarcinoma, (2) adenocarcinoma, (3) alveolar adenocarcinoma, (4) alveolar carcinoma, (5) giant-cell carcinoma, (6) squamous-cell carcinoma, and (7) sarcoma. Representative photomicrographs are shown.

The authors determined by their physical examinations that thyroid cancers could be soft, not all being hard in consistency. They think that microscopic observation of tumor cells in the blood vessels is not necessary for a diagnosis of carcinoma of the thyroid gland and is not always a reliable criterion of malignancy.

Carcinoma of the thyroid so extensive as to preclude operation other than biopsy should not be considered hopeless inasmuch as a patient with such a condition was reported to be alive without recurrence 8 years after diagnosis and treatment with roentgen rays.

The authors believe that recurrent malignant nodules should be removed.

One case of hypothyroidism present in a patient with carcinoma of the thyroid is presented.

W. FOSTER MONTGOMERY, M.D.

# SURGERY OF THE NERVOUS SYSTEM

## BRAIN AND ITS COVERINGS CRANIAL NERVES

Functions of the Frontal Lobes. W. RITCHIE ROSELL. *Lancet* Lond., 1948, 1: 356.

As far back as 1878 Ferrier in England wrote that the removal of the frontal lobes causes no motor paralysis or other evident physiological effects but causes a form of mental degradation.<sup>1</sup> Fulton (1943) writes that the types of deficit observed after removal of the frontal lobes relates to alterations in behavior—to intellectual deficits.

There is still some disagreement whether removal of one or both prefrontal lobes necessarily causes much change in intelligence or personality but no one will dispute that the so-called frontal lobe syndrome occurs. The famous American crowbar case of nearly a century ago is cited by the author and provides a remarkable record of bilateral frontal lobe injury.

In the experimental field progress has also been limited. Ferrier 75 years ago found that bilateral removal of the prefrontal area in monkeys caused considerable psychological alteration in their behavior. Jacobsen's (1934) observations on the effect of prefrontal lobectomy in experimental neurosis were of exceptional importance, for he clearly showed that the behavior of a chimpanzee with neurosis and temper tantrums was completely altered by the operation. The neurosis was cured at the expense of losing some ability to solve problems. This led to the application by Moniz (1936) of the operation of frontal lobotomy in man which is now so widely practiced.

Two facts stand out clearly: (1) there is little difference between the effects of removing the right or the left prefrontal lobe and (2) the removal of both prefrontal lobes causes more intellectual deficit than does the removal of one only. It also seems clear that the effect of removal varies from case to case as was shown by the studies of Kleist and others in Germany on frontal wounds after the war of 1914 to 1918.

An evaluation of frontal brain wounds in the late war disclosed that in most frontal lobe wounds fair recovery takes place. Of 75 unselected patients who have recovered from a frontal brain wound 66 (88%) are in some form of employment 2 years after wounding although the employment is often of a simple kind. There is often evidence of some change of personality and intellectual deficit. This is sometimes difficult to demonstrate by psychometric tests, and often the evidence provided by an intelligent patient or by his relations gives the best indication of his disability. Common symptoms are restlessness, inability to maintain attention or to plan, lack of self control, difficulty in learning, failure at technical or professional occupations, loss of interest in former hobbies or games, tactlessness, fatigability and more rarely nocturnal enuresis.

The author then discusses the effects of frontal lobe injury on emotional reactions and memory. The pattern of adult human behavior must depend to a large extent on memory and it is clear from studies of both frontal wounds and of frontal-lobe operations that the processes of memory are not centered chiefly in the frontal region. It seems evident that the removal of neither the whole right hemisphere (the left being dominant) nor both prefrontal lobes leads constantly to gross loss of established memories or alteration of behavior or intelligence in the adult.

There is some evidence to show that the mental effect of brain disease in children differs from that in adults. For example, it is well known that severe head injury or encephalitis in small children may lead to persistent disorders of behavior and arrest of mental development. It is, however, not known whether injury to the frontal lobes plays an important part in this clinical picture. Some evidence of the importance of the frontal lobes in the development of intelligence in childhood is provided by the association of amentia with atrophy or arrest of development of the frontal lobes (Bolton 1914).

Both the study of frontal wounds and the effects of frontal lobotomy in the adult indicate that the basic pattern of behavior is not represented in the frontal lobes yet this frontal mechanism may possess the power to exert a decisive influence in controlling the main behavior patterns which seem as has been mentioned to be established in the posterior parietotemporal region of the dominant hemisphere. The study of children who have had severe frontal lesions suggests not only that their behavior is disinhibited and as one teacher remarked "he behaves like a monkey," but also that they cannot be educated. The study of patients with frontal lobe damage suggests that a loss of ambition and drive plays a part in their general ineffectiveness in the rush of modern life. The same incentives to succeed in life remain, but these do not elaborate the ambition necessary to provide for sustained and efficient mental and physical activity.

It seems that the beneficial effect of prefrontal lobotomy in relieving mental tension and severe anxiety may act in one of three ways: the operation prevents the relay of the nervous activities engendered by mental conflict to the frontohypothalamic mechanism; the fire of the mental conflict loses its fuel when no longer stimulated by this mechanism or most likely the mechanism of mental conflict at a cortical level is highly complex and may be directly interfered with by this operation to such an extent that it can no longer develop the intensity required to stimulate the emotions. However it is not yet possible to say which of these alternatives is the most important.

In conclusion the author states that the time is now ripe for investigation of the psychic results of

Injury to different parts of the frontal lobes and that the evidence suggests that we have all used our prefrontal lobes to a great extent in the past to build up our own peculiar way of thought and life and to exploit our emotional capacity to provide the necessary drive to work. Most of us can still use them to enable us to work long hours to change our habit and to plan along untried paths. In our later years it is easier to travel on the well worn paths of thought and behavior so if our mental conflicts become intolerable we may then gain something by having our prefrontal lobes destroyed.

HOWARD H. LAXTER, M D

**Pain Mechanisms and the Frontal Lobes: A Study of Prefrontal Lobectomy for Intractable Pain**  
WALTER FREEDMAN and JAMES W. WATTS. *Ann Int Med* 94:3, 28-747

Despite the widespread interest in the relief of pain by prefrontal lobectomy there has been a gross lack of understanding of its mechanisms. The short dissertation presented by these authors should help to dispel many of the vagaries associated with this problem. Although philosophers have argued in the past as to whether pain is a sensation or an emotion, the authors have elucidated this problem quite clearly by showing that the somatic quantitative recognition of pain stimuli is not interfered with in prefrontal lobectomy. However the emotional components of pain and emotional threshold are greatly influenced by this procedure. This is most clearly presented by the authors own words "Prefrontal lobectomy has a beneficent action upon pain whether it is primarily mental or primarily physical. It does not interfere with the perception of pain but rather with the evaluation of pain. It does not relieve pain but rather the disabling reaction to pain, the fear of pain. It does so apparently by eliminating the emotional component arising from the thalamus."

Although definite indications for prefrontal lobectomy in the relief of pain are not yet fully evaluated, it is thought to be a very valuable procedure in cases of pain in which suffering produces marked disability and in which the outlook for improvement under other measures appears very unsatisfactory. The authors believe that the procedure should be used more often in the relief of severe pain.

JACK I. WOOLF, M D

**Hydrocephalus, and Hydrocephalus with Meningocele: Their Treatment by Choroid Plexectomy** LEO M. DAVIDOFF *Surg Clin N America*, 94:3, 33-46

This article is a plea for removal of the choroid plexus in the properly chosen patient with hydrocephalus, now that better and safer operative techniques are at hand. A brief but interesting review of the more authoritative opinions on the physiology of the cerebrospinal fluid is given. Obviously, be the fluid an excretion or secretion, anything which interferes with its free circulation (as obstruction of its pathways) or its prompt absorption (as impair-

ment of function of the arachnoid villi) will result in an accumulation of the fluid under pressure.

Following a brief critique of Dandy's operation of third ventriculotomy the author reports that he has operated upon 33 babies by the choroid plexectomy procedure for the relief of hydrocephalus. The diagnosis was always confirmed by means of ventriculography or by ventricular estimation. He does not feel it particularly necessary to determine or know whether or not the hydrocephalus is communicating or "noncommunicating." Nineteen patients were operated upon by bilateral plexectomy and 13 were operated upon on one side only. At the time of initial operation the ages of the patients varied from 5 weeks to 15 months. In 9 patients there was an associated meningocele and the operation of plexectomy is believed to aid in the treatment of that lesion when it also exists.

In preparation for the operation, the lower portion of the calvarium is supported in a plaster nuchle cast to support it at the time of ventricular drainage. Through a small temporoparieto-occipital flap the cortex is incised, the ventricle drained, and as much of the plexus coagulated (clipped and excised, if that seems feasible) as is possible. The ventricle is then filled with warm Ringer's solution freshly made.

Fourteen of the 32 patients are known to have died 7 immediately after operation or within a few days after operation. Some of the patients were obviously very poor surgical risks and death was not surprising with or without operation. Infection occurred in some patients when a meningocele was also present, the infection probably gaining access to the subarachnoid spaces from the meningocele rather than from the operative wound. In 3 of the 9 patients with associated meningocele the meningocele healed spontaneously, but in 4 of these patients the meningocele required surgical repair. Several case reports are appended to illustrate difficulties as well as success with this operation, one of the major neuro-surgical challenges.

JOHN MARTIN, M.D.

**Focal Epilepsy: Correlation of the Pathologic and Radiologic Findings.** DONALD L. MCRAE. *Radiology* 94:3, 501-439.

In this article the author considers the verification of foci of brain pathology resulting in epilepsy as they are demonstrated by means of radiology and clinically by physical examination of the seizure itself, and operative verification. He has found that atrophic lesions of the brain in children are often associated with a smaller hemisphericum on the affected side, this disparity being shown by accurately made x-ray pictures of the skull. In the 160 patients studied from the Montreal Neurological Institute and Children's Memorial Hospital of Montreal, atrophic cerebral lesions were compared roentgenologically with meningocerebral electrical lesions. The common meningocerebral cicatrix was associated with focal ventricular dilatation in 80 per cent of the patients and with demonstrable subarachnoidal cysts in 18 per cent. There was also, a great incidence of

specific bone changes which the author has come to believe are characteristic of this sort of cerebral focus. In the second largest group of patients, those with the simple forms of cerebral atrophy and in whom there was so frequently seen a cranial hemiatrophy, bone changes other than hemiatrophy were relatively uncommon. focal ventricular dilatation was present only in 38 per cent of the patients and subarachnoidal cysts were present in only 5 per cent. In a third group of patients, 9 with blood vessel abnormalities, intracerebral calcification occurred in 44 per cent, an incidence 15 times greater than that in any other group. Among the patients with blood vessel abnormalities there were occasional instances in which an atrophic or actually a space-occupying lesion might have been suspected.

In 8 patients plain roentgenograms and pneumograms of the skull indicated an atrophic lesion on the side clinically opposite that of the epileptogenic focus. The nonvisualization of collections of fluid such as subarachnoidal or intracerebral cysts was the source of most of the errors in diagnosis.

JOHN MARTIN, M.D.

**Intracranial Aneurysm of the Internal Carotid Artery in Willis's Polyagonal Space. Dandy's Operation. Recovery (Aneurisma Intracraniano de la carótida interna, en el polígono de Willis. Operación de Dandy; Curación). EDUARDO C. PALMA.** *Bol. Soc. cir. Uruguay* 1947 18 571

A man aged 65 had had an episode of meningeal hemorrhage 1 year prior to admission. His chief complaint was an intensive headache in the right frontotemporal region. The physical examination revealed diplopia, ptosis of the right upper eyelid, pain in the right orbital region and severe headache in the right frontotemporal region radiating toward the neck. The patient's blood pressure was 200/120.

The history of a meningeal hemorrhage combined with unilateral paralysis of the oculomotor nerve and frontotemporal headaches on the right side suggested the diagnosis of an intracranial hemorrhage of the right internal carotid artery. The diagnosis was confirmed by arteriographic findings.

An operation was performed under local anesthetics after a period of 6 weeks during which a digital compression had been employed daily. A frontoparietal temporal osteoplastic flap was formed and an aneurysm of the right internal carotid artery in the region of Willis' circle was exposed. The carotid artery was ligated in such a manner as to leave the anterior communicating branches intact. The mental condition of the patient was not affected during the operation by the ligation.

No serious complications developed during the postoperative course. Penicillin injections and local applications of sulfathiazole promptly eliminated a small area of osteitis in the parietal region. A metallic murmur synchronous with the pulse and probably caused by the clips could be heard during the early stages of convalescence but disappeared later on. The paralysis of the oculomotor nerve remained

unchanged but the headaches disappeared and the great danger of a recurrence of the meningeal hemorrhage caused by rupture of the aneurysm was completely eliminated.

JOSEPH K. NARAY, M.D.

**The Surgical Treatment of Certain Intracranial Arterial Aneurysms.** RICHARD D. SWAIN. *Surg. Clin. America* 1948 18 396.

Although the diagnostic criteria of ruptured intracranial aneurysms are well recognized, the surgical treatment remains a frontier in neurosurgery. The author reports 4 cases of aneurysm of the left middle cerebral artery in patients who have not been considered amenable to surgery. Three of the patients were cured by ligation and coagulation of the aneurysm. One patient had suffered very severe cerebral damage from the aneurysm and although the aneurysm was coagulated there was a partial residuum of the cerebral damage.

The operative procedure was carried out through a left frontotemporoparietal osteoplastic craniotomy. In each case the aneurysm was located with a searcher inserted into the temporal lobe. In 2 cases an incision was made in the temporal lobe exposing the hemorrhagic area and aneurysm. In 1 case the aneurysm was exposed through the Sylvian fissure.

The author strongly advocated the use of a wide-mouthed sucker which not only immobilized the aneurysm but also cleared the field of hemorrhage.

In this remarkable series there were no deaths and in 2 of the patients there were no neurologic sequelae.

JACK L. WOOLFE, M.D.

**Fundamental Anatomy and Neurology for the Surgical Treatment of Apoplexy (Fondamenti anatomico-neurologici per il trattamento chirurgico dell'apoplessia cerebrale).** CORNELIO FAZIO. *Chirurgia* 1947 2 404.

In the author's statistics on 150 cases of apoplexy, it was shown that 54 per cent of the patients died from hemorrhage while 46 per cent died of softening from ischemia or hemorrhage.

Recent publications, especially those of French neurosurgeons, advocate surgical procedures only for the treatment of a certain group of cerebral hemorrhages termed intracranial hematomas. Such lesions are localized in the white substance of the hemispheres, especially in the frontal or temporal regions, and frequently cause an endocranial hypertension.

The author indicates various types of cerebral hemorrhage by reporting personal observations. He draws the conclusion that surgery may be indicated also in cases of hemorrhages in other locations not including those in the nuclei at the base of the brain and erroneously called capsular hemorrhages. Excellent results may be obtained with surgery in intracerebellar, endoventricular hematomas.

In differentiating cerebral hemorrhages from tumors, ventriculography, encephalography and arteriography are of great help.

ARTHUR F. CITOLLA, M.D.



**Voluminous Angioma at the Base of the Brain (Voluminoso angioma della base encefalica)** F. MASCHERPA and A. PALERMI. *Chirurgia*, 947: 335.

Malformations and tumors involving the blood vessels may be divided into the following groups: (1) angioma cavernosum, (2) angioma racemosum, (3) angioreticuloma, and (4) angiolipoma. The second group includes several varieties of tumors, the arteriovenous aneurysm being the most important from the clinical point of view. Various other terms have been applied to it, namely arterial angioma, cirroid aneurysm, arteriovenous angioma, arteriovenous aneurysm, aneurysmatic angioma, or arteriovenous hamartoma.

The author treated a 10-year-old patient who, at the age of 8 years, developed a left hemiparesis accompanied by headache and vomiting, hyper-tension, papilledema, and lymphocytosis of the spinal fluid appeared a few days later. A similar episode developed 1 month after the first.

Encephalographic studies revealed the presence of a mass in the lumen of the right lateral ventricle. Arteriography disclosed an angiomatous mass, directly communicating with the corresponding internal carotid artery in the lower portion of the right cerebral hemisphere.

Following intensive roentgen therapy all symptoms disappeared and a check-up examination 8 months later showed the patient to be in a good condition.

The author calls attention to the curative effect on angiomas of intensive roentgen treatments.

JOSUË K. NAR. M.D.

**End Results following the Capsular Operation for Parkinsonism.** JEFFERSON BROWDER. *Surg. Clin. N. America*, 94A, 3: 390.

The capsular operation for the relief of Parkinsonism consists of the section of the fibers of the anterior limb of the internal capsule up to a few millimeters rostral to the genu of the internal capsule. This operation should be limited to patients under 50 years of age and preferably those having definite unilateral predominance of symptoms. It should be remembered that the operation is definitely palliative and does not alter the usual course of the disease. Although it may be performed on the dominant hemisphere, a transient speech defect may be anticipated during the postoperative period for approximately 3 months. Aside from the complications of surgery, there is usually no paralysis. A mild paresis is often present and is usually desired although, in some patients, there may be no discernible paresis.

The author suggests that the operation be performed only on one side. If however there is bilateral involvement, the opposite side might be brought under control by a posterolateral chordotomy as advocated by Putnam.

The article was derived from a symposium on neurosurgery and does not give a complete discussion of the operative procedure or the percentage of

results and complications. Three cases with variable results are presented and discussed.

JACK I. WOOLY, M.D.

## SPINAL CORD AND ITS COVERINGS

**An Evaluation of Curare in Spasticity Due to Spinal-Cord Injuries.** ROBERT A. KIRBY and DONALD S. BICKER. *N. England J. M.*, 94A, 72: 63.

The authors attempted to evaluate the effect of curare in 34 patients who were suffering from spastic paraplegia due to complete or incomplete traumatic lesions of the spinal cord. They conducted two independent series of study. In the first, 17 patients received intramuscular injections of 175 mgm. of d-tubocurarine chloride in oil and white wax over 48 hours for 10 doses, and in the second, 17 patients were given an equal volume of physiologic saline solution intramuscularly throughout the same treatment period. No differences in the patients' reaction could be found in the two series.

The authors observed no relief of the spasm or other beneficial effects from the treatment of spasticity by the injection of tubocurarine in oil and wax, and toxic effects were frequent. However transient beneficial effects were reported following the injection of aqueous curare.

GEORGE PARKER, M.D.

## PERIPHERAL NERVES

**The Effect of Occlusive Arterial Diseases of the Extremities on the Blood Supply of the Nerve.** Experimental and Clinical Studies on the Role of the Vasa Nervorum. JOSEPH THOMAS ROBERTS. *Am. Heart J.*, 1943, 35: 360.

Attention is called by the author to the importance of the circulation of the peripheral nerves in relation to their physiological activities. Experiments have been conducted to determine the effects of devascularization of the peripheral nerves.

The various types of experiments undertaken were as follows:

1. Ligation of a segmental nutrient artery of a peripheral nerve dogs being used as experimental animals. A segmental nutrient artery was divided between ligatures without trauma to the nerve. Chicago blue dye was then injected into the aorta, and the animal was sacrificed. No clinically discernible evidence of dysfunction of the sciatic nerve was found following this procedure. When all nutrient arteries coming to the sciatic nerve between the hip and knee joint were destroyed, weakness of the extensor muscles of the foot and of the hamstring muscles was noted.

Histologic study revealed only occasional degenerated axones, especially near the periphery of the nerves.

2. Stripping of the perineurium was carried out in varying degrees. When stripping was carried out over a distance of between 1 and 3 cm. no changes in nerve function were noted. However when the

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epineurium was stripped away from all or most of the segment of the nerve between the hip and knee. Impaired function of the nerve was shown by weakness of the extensor muscles of the foot and of the hamstring group of muscles by drop foot with trophic ulcers on the dorsal surface of the foot and partial or complete loss of sensibility to pin prick, pinching or heat.

Histologic study in this experiment revealed degeneration of many axones, especially those with large, myelinated sheaths. Axones near the periphery of nerve bundles were affected more than those in the central part of the nerve.

3. Stretching of the nerve was accomplished only by severing of the knee joint and consequently no survival studies could be made. Dye was injected into the aorta while the nerve was being stretched and the animal was then sacrificed. Examination revealed the stretched nerve to be white, showing very little injection from the dye which indicated that the vasa nervorum may be obliterated by stretching the nerve.

4. Constriction of the nerve by tourniquet followed by injection of the dye revealed a considerable degree of ischemia of the nerves at the point of constriction and for several centimeters below although the tourniquet had been so placed as to compress all structures except the femoral artery and vein.

5. Obliteration of the vasa nervorum was obtained in several animals by injection of sterile graphite or Lycopodium spores into the nutrient artery of the left sciatic nerve. Evidence of impaired nerve function was found upon recovery from the anesthesia and there was further evidence of nerve deficit evidenced by decreased sensibility to painful prick, pinching or heat over the area supplied by the branches of the devascularized sciatic nerve. After a few days to two weeks loss of tone, severe wasting trophic ulcers and dry gangrene developed.

Histologic examination revealed degeneration of the nerve below the site of impaired blood supply similar to that which would be expected with severance of the nerve.

Several reports are included of cases in which vascular occlusion resulted from emboli due to coincidental disease, such as subacute bacterial endocarditis, chronic thrombosis, diabetes and other conditions.

The injection of dye has shown that the blood supply of the nerves is quite abundant, and can be seriously impaired or obliterated by the various procedures described. HOWARD A. BROWN M.D.

**Plasma Silk Suture of Nerves.** JAMES E. BATEMAN  
*Ann Surg* 1948 127: 456

This article is based on the combined use of plasma and silk in the union of 350 divided human nerves. Two silk sutures are placed one fourth inch from the nerve ends to aid in gross approximation and release of tension. Plasma is used for the finer approximation and as a protective covering at the suture line.

The technique of plasma preparation does not depend upon anticoagulants. Thirty cubic centimeters of blood are withdrawn from the patient into a sterile test tube after the operation is started. This is centrifuged in ice-lined containers for a period of 3 minutes at 3500 r.p.m. The plasma is kept in ice until needed. It is then poured into a mould of the type devised by Tarlov.

The author lists some of the limitations of this method of nerve approximation. Application of the mould in inaccessible regions is awkward, some injuries cause great loss of nerve and severe tension results.

The following advantages of the combined silk-plasma technique are given: buckling of the approximated ends is avoided. By avoiding sutures at the line of union there is less danger of damaging the nerve bundles and initiating bleeding. The plasma aids in the immobilization at the suture line and favors the growth of nerve fibers across the gap in orderly fashion. The protective covering of the plasma minimizes the encroachment of fibrosis from adjacent structures into the suture line.

DANIEL RUOY M.D.

### SYMPATHETIC NERVES

**Indications for Sympathectomy in the Treatment of Hypertension.** THOMAS FINDLEY *Surgery* 1948 23: 639

The author points out that anyone studying large groups of sympathectomized hypertensive patients must be impressed by certain facts. In particular these are that the operation has not been placed on a rational basis, it seldom produces manometric cure, it is often followed by spectacular improvement of symptoms, the results are apt to be temporary and that the treatment is violent. It is pointed out also that hypertension is not a disease but a symptom and hence many factors in the normal organism may play a part in its production. All of these factors have a vasoconstrictor influence and either the effect of one or the summation of many of these may be the stimulus in the production of hypertension. The factors are listed as (1) constitutional (2) arteriosclerosis (3) renal (4) nervous (5) endocrine (6) pregnancy and (7) unknown factors. Since we do not know the exact mechanism by which sympathectomy produces its beneficial effects in the hypertensive patient, it is impossible to carefully evaluate its influence on these various factors.

In a study of 100 hypertensive patients who had undergone bilateral splanchnicectomy and sympathectomy, the author has come to the definite opinion that the peripheral vasodilatation and enlargement of the vascular bed is only temporary. He has invariably found that the blood pressure slowly rises after surgery to somewhat near or below the preoperative level. Since postural hypertension usually disappeared within 1 year in the majority of cases, this effect is considered an undesirable complication of surgery rather than an asset. With

the present evidence of the humoral theory of hypertension the possibility that sympathectomy may modify the chemical composition of the blood in some favorable manner must be considered. Modification of the activity of the adrenal cortex must also be considered a possibility in the mechanism of the effect of sympathectomy. Although the possibility of the psychic effect of sympathectomy upon the blood pressure of the patient has been suggested by some this does not seem to be a very likely possibility. There is no reliable test that will give a satisfactory indication of the effect of sympathectomy. The more common procedures such as the cold pressor test, the amylal sedation test, splanchnic block and the induction of high spinal anesthesia have all proved unreliable.

In the authors' experience the amylal test has usually given false optimistic results. In view of this the feeling is that disappointments will be fewer if the operation is reserved for those with disabling symptoms and those with early malignant hypertension but the manometric results will, of course be better if the patient also has a labile blood pressure.

JACK I. WOOLFE, M.D.

#### MISCELLANEOUS

**Hypertension—Etiology and Surgical Treatment.**  
GROFFREY BOURNE. *Br J* 1948, 435

In the light of some of the recent works of Trueta and his coworkers at Oxford in 1947 the author expresses some of his views regarding the etiology and surgical treatment of hypertension.

By experimental work on animals, Trueta proved that an extreme degree of cortical renal ischemia can be temporarily produced by vascular spasm. Furthermore during this state of cortical spasm the blood is by-passed through the juxtamedullary glomeruli back into the vasa recta and so into the renal vein. The cortical ischemia is fairly persistent and is produced by various nervous stimuli, but it also can be brought about by a humoral agency such as a posterior pituitary extract.

The success of sympathectomy for hypertension is likely to vary greatly according to the stage of the disease and the underlying pathological state, which therefore must be considered separately. During the first stage the increasing blood pressure may well be caused solely by spasm of the renal cortex, at first transitory, but later continuously involving varying areas of the renal cortex for most of the 24 hours. During the second stage permanent organic

renal disease will result from arterial degeneration and will constitute a permanent source of renal cortical anoxemia. Thus in each of these two stages the hypertension can be explained on the renal theory. In both states the renin comes presumably from transitory cortical spasm, and during the second stage it also comes from permanent cortical ischemia due to arteriosclerosis.

It is the author's feeling that during the first stage, sympathectomy is indicated and will produce a good result. However, in the second stage the result will be poorer. He also presents several cases in which there has been a definite decrease in the size of the heart and improvement in the respiratory function following sympathectomy.

The effect of sympathectomy upon hypertension appears to vary considerably from case to case. The general experience hitherto seems to be that the operation is most successful in younger patients, particularly those under 40 years of age and those in whom the diastolic blood pressure figure is considerably raised so that there is a comparatively small pulse pressure. The operation is usually not helpful in patients with advanced cardiovascular or renal disease but here exceptions occur, especially in the younger age groups. The author discusses the use of the sodium amylal test and other work up including retinoscopy by a skilled ophthalmologist, a complete examination of the urine, urea-clearance test, the urine-concentration test, an electrocardiogram, radiology of the heart, and sometimes intravenous pyelography. Coronary heart disease is a contraindication to sympathectomy for hypertension.

Careful investigation and observation of a patient with hypertension should have as their chief aim the determination of the following two points: the previous duration of the disease, and an estimation whether the condition is in a stationary stage or whether there is the slightest indication of recrudescence or exacerbation.

There is at present no clinical test available which will enable us to judge the position exactly, but it is probable that a periodic thorough and careful investigation of the retinal arteries by a skilled ophthalmologist is likely to provide the best guide to whether the onset of arterial degeneration is beginning to threaten. A periodic careful investigation of the renal function is also desirable in such cases. Finally it is important that every case be considered on its individual merits—general, cardiological, renal, familial, and psychological.

HOWARD H. LARSEN, M.D.

# SURGERY OF THE THORAX

## CHEST WALL AND BREAST

**Bleeding Nipples** (Sul sanguinamento del capezzolo)  
ANTONIO VOLTERRANI. *Chirurgia* 1947 2 545

Bleeding nipples were observed by the author in 2 cases of fibrocystic disease of the breast in 1 case of endocannicular papilloma 1 case of Paget's disease and in 2 cases of dendritic endocannicular cystoepithelioma.

From his observations the author draws the conclusion that bleeding nipples are not characteristic of any lesion but that the bleeding is caused by diapedesis and rupture of the walls of the capillaries which are in direct contact with excretory ducts or cystic cavities communicating with them.

Among 425 patients with breast lesions, excluding acute mastitis bleeding nipples were observed in 6 or 1.41 per cent of the patients

Bleeding nipples may be caused by

- 1 Functional disturbances (a) menstrual hyperemia (b) vicarious menstruation (c) neurosis.
- 2 General conditions (a) locomotor ataxia, (b) arteriosclerosis, (c) hemophilia (d) purpura.
- 3 Local lesions (a) trauma (b) inflammatory processes of excretory ducts (c) dysplastic degenerative processes such as fibrocystic disease or primary cystic dilatation of excretory ducts (d) benign neoplasms (e) malignant neoplasms.

Bleeding nipples have neither diagnostic nor prognostic value as far as the treatment is concerned, it is determined by the character of the underlying lesion

JOSEPH K. NARAT, M.D.

**Mammary Cancer** G. E. RICHARDS. *Brit J Radiol* 1948 21 109.

Cancer of the breast ranks fourth in frequency of the malignant diseases and is responsible for 12 per cent of all deaths from cancer

Two methods available for treatment are surgery and radiation therapy, either alone or in combination. The results of the proponents of the various methods have varied considerably. Consequently the author analysed all the methods used in a series of 1,271 cases covering the 10 year period from 1933 to 1943. Of particular interest was the author's desire to determine whether certain popular ideas were actual facts namely (1) breast cancer is more malignant in the younger age group (2) induction of the artificial menopause exerts a favorable influence on the course of the disease and (3) radiotherapy is or is not, capable of irradiating the disease.

Radical surgical results with regard to 5 year survival have varied from 22.2 per cent as reported by Haagenson and Stout to 36.9 per cent as reported by Geschickter. The author's 5 year survival rate with the Steluthal clinical classification was 70 per cent for stage 1 from 25 to 30 per cent for stage 2 and 5 per cent for stage 3

When radiation therapy was added to radical mastectomy the results were improved. For the stage 1 group of 147 patients who received post operative irradiation the 5 year survival was 81 per cent. For stage 2 it was raised from 30 to 43 per cent, and for stage 3 from 5 to 13 per cent. Additional use of preoperative irradiation improved the 5 year survival rate for stage 2 from 43 to 50 per cent and for stage 3 from 13 to 45 per cent.

Dissatisfaction is expressed over the present method of attempting to evaluate the disease and its treatment. Several factors should be considered carefully before any form of therapy is undertaken. They are (1) clinical stage of the disease (modification of Portmann's classification) (2) influence of the size and duration of the tumor (3) influence of the location of the tumor i.e. the outer or inner hemisphere, with or without node involvement (4) histopathology of the tumor (5) age of the patient, (6) influence of the ovarian function, lactation and pregnancy and (7) type of operation, i.e. local excision, simple mastectomy or radical mastectomy

In order to correlate these factors which undoubtedly influence the course of the disease the formula of Lee and Stubenford called the Clinical Index of Malignancy has been used. To each of the enumerated factors a numerical value is given thus clinical index equals lactation factor plus twice the age factor plus 3 times the site factor plus 4 times the growth rate plus 5 times the stage (C.I.M. =  $2L + 2A + 3S + 4R + 5E$ ). If the clinical index adds up to between 10 and 30 the degree of malignancy is low and the prognosis is good. If the total adds to between 31 and 40 the degree of malignancy is intermediate, and if it is above 40 the degree of malignancy is high and the prognosis unfavorable.

As a result of this extensive analysis the author believes that in the stage 1 group with a clinical index between 10 and 30 therapy should consist of radical mastectomy followed by irradiation only in selected cases. Five year survival should be between 75 and 90 per cent. In stages 2 and 3 with a clinical index between 31 and 40 choice of treatment should be preoperative irradiation, radical mastectomy and in some instances postoperative irradiation. Five year survival should range from 65 to 70 per cent. Patients in stages 4 and 5 with a clinical index between 41 and 60 should be treated by irradiation. Some inoperable patients may become operable. However the majority are cared for by radiation therapy. Five year survival should range from 35 to 43 per cent.

The best results in the treatment of carcinoma of the breast can be obtained by the judicious use of surgery and radiation therapy. Age is not a factor in the prognosis. The value of routine sterilization of women in the premenopausal period is still to be proved. Radiation was able to control the primary

disease in 47 per cent of the patients treated. A general plan for the management of breast cancer is suggested which, if followed, would increase the 5 year survivals and reduce the number of postoperative recurrences. **MARCELO D. SACIA, M.D.**

### TRACHEA, LUNGS, AND PLEURA

**Bronchoscopy in Bronchiectasis in Children** E. LAMONTE GARA. *Ann. Otol. Rhinol.* 94:5, 57-58.

The literature on the incidence of sinus disease in bronchiectasis is reviewed. The relationship remains indefinite. Bronchography in children is discussed. The authors prefer the use of local anesthesia and the catheter technique. They believe general anesthesia to be time-consuming and tedious. It is rare to find a child 4 years of age or over who cannot be intubated without having to be retrained. Nitroprusside, morphine and barbiturates are given before the procedure, all or part of the medication being omitted in some cases depending upon the age or condition of the patient. One side of the nose, the pharynx, and the larynx are anesthetized with pontocaine in a 5 per cent solution. A flexible rubber catheter is passed through the nose and larynx into the trachea, and pontocaine is instilled into the trachea through the catheter. The radiopaque oil is then injected under fluoroscopic control. All lobes of both lungs are mapped at one sitting.

**JAMES R. LEXDA, M.D.**

**Examination of Sputum for Tumor Cells. II** MATTHEWS. *Cancer* 11:411-12, 94:5, 58-59.

Matthews calls attention to the value of employing routine examination of the sputum for tumor cells. Twenty-four hour or overnight specimens are utilized. If abundant sputum is expectorated the morning sample may be used. The bulk of this is enclosed in a gauze bag and fixed in Bouin's solution. Thereafter it is treated as a block of tissue embedded in paraffin, sectioned and stained with hematoxylin and eosin. The diagnostic features are those acceptable for carcinoma cells seen elsewhere in the body, such as abnormally large cells with a large or bizarre nucleus occupying a undue proportion of the cell volume, hyperchromasia, and cells having single or multiple nucleoli. Mitotic figures also may be found.

Thirty-three cases observed over a 3 year period are reviewed. A positive diagnosis was made in 24 cases (72.7%) in which bronchogenic carcinoma was either proved or reasonable certitude was obtained.

**STEPHEN A. ZIEGLER, M.D.**

**On the Anatomy of the Parietal Pleura and Adjoining Thoracic Wall.** K. KIVIAKANGAS and PIERRE TUVONEN. *Ann. med. exp. biol. Scand.* 94:7, 5-29:3.

The authors present their macroscopic and microscopic observations on the construction of the parietal pleura and adjacent thoracic wall. Five newborn and 30 adult specimens were studied in detail. Samples were taken from the costal part of the thoracic wall

from the region of the mediastinal organs and from the diaphragm. The pleura was observed to be loosely attached to the surrounding tissues. Along the diaphragm alone the connection is firm.

The division takes place in the stratum next to the parietal pleura, consisting in the costal part of the thoracic cavity and in the pericardiac area of thin fibered loose connective tissue and, in many cases, in the area of the great veins, the trachea, and the esophagus of adipose tissue as well. The construction of the pleura itself displays considerable variety. Often it is made up of endothelium, and a thin stratum of looser tissue between can be distinguished. The pleura can often be cleft into two separate parts, between which the blood vessels, which provide for the nutrition of the pleura, are situated. In the area of the intercostal muscles a membrane of varying thickness may be separated. It is fastened to the periosteum where it meets the costae and must be looked upon as the fascia of the intercostal muscles.

The investigations refute the idea that a fascia endothoracica, i.e., a uniform fascia covering the inner wall of the thoracic cavity, exists unless the loose stratum of thin-fibered connective tissue between the parietal pleura and the different organs of the thoracic cavity is to be regarded as such. This last named is the proper stratum in which the extrapleural stripping of the lung has to be performed. The uncertainty that has prevailed up until now seems to be due to the fact that in default of microscopic investigations it was not known that the parietal pleura may be made up of two parts which also can be separated from each other with relative ease.

**STEPHEN A. ZIEGLER, M.D.**

**The Interlobar Pleuritis (Les pleuritis interlobaires)** MARCEL BERNARD, PIERRE FRANKET, and JEAN DUMAREST. *J. f. med. chir. thorac.* 94:7, 369.

Since 1940, the authors have observed 13 cases of interlobar pleuritis. During the same period they have treated surgically 200 patients with abscesses of the lungs. They state that the incidence of interlobar pleuritis is from 6 to 7 per cent of all cases of pleuropulmonary suppurations, with the exception of suppurative pleuritis of the large pleural cavity. Only the indisputable cases have been classified as interlobar pleuritis by the authors.

The diagnosis of this disease is based upon knowledge of the topography of the interlobar fissure. The diagnosis is difficult if only an anteroposterior radiographic film of the chest is taken; a collection involving the entire main fissure will cast a shadow occupying almost the entire lung field except the apex and the costodiaphragmatic angle; a collection localized in one part of the main fissure will cast a shadow occupying only one segment of the lung field and of varying location. This suspended shadow is not at all singular except for its lower border which is well defined and curved (Beitz and Kaufmann).

As early as 1926, Lenoir called attention to the importance of the lateral radiographic film of the

# SURGERY OF THE THORAX

chest. He described the spool shadow crossing the lung field obliquely at the level of the main fissure. This shadow will occupy either the entire fissure or its upper or lower segments ending in the neighborhood of the junction of the fissures. The small fissure being anatomically incomplete in a large percentage of the cases is rarely the seat of the pyogenic collection. If the small fissure is the seat of the pathology the base of the interlobar collection in the anteroposterior view will be supradiaphragmatic and will be anterior on the lateral film ending posteriorly near the hilus, overlapping the cardiac shadow in front to the thoracic wall and separated from the diaphragm by a layer of normal pulmonary parenchyma. One must remember that if the collection becomes large the typical spool shadow is no longer present but is replaced by the shadow of a triangle at the top or a drop and, more rarely of a triangle at the inferior segment of a fissure. The characteristic location and direction will however always remain.

With the exception of their localization, the general of the interlobar pleuritis is similar to that of the encapsulated collections of the main cavity. It sometimes constitutes the residue of a diffuse empyema of the whole pleural cavity. It is usually secondary to a cortical pulmonary focus.

Depending upon the extent of the pulmonary infection, the interlobar pleuritis are classified in two categories: (1) the interlobar pleuritis associated with lung abscess and (2) the clinically autonomic interlobar pleuritis. The former type is fairly common but as a rule is difficult to diagnose. At first all of the signs and symptoms indicate the usual lung abscess and the roentgenogram is of great importance in establishing the diagnosis. There can be an area of consolidation with or without destruction of the lung parenchyma. The lateral film reveals that the area of consolidation is in the immediate vicinity of the fissure and this is also confirmed by the bronchogram. Moreover part of the shadow may take the characteristic shape of a spool. Often however the diagnosis is made only at operation for drainage of the collection thought to be exclusively located in the pulmonary parenchyma. The surgeon will then discover an interlobar empyema communicating with the pulmonary focus through a fistulous tract.

The treatment remains the same no matter how inconclusive the roentgenogram may be of a coexistent interlobar collection. The pleurosis is only an epiphenomenon of the pulmonary focus and will heal following single drainage.

The interlobar pleuritis clinically autonomic, constitute the characteristic picture of interlobar empyema. The patient seeks medical advice because of an infectious syndrome which has an acute or progressive onset and is refractory to sulfonamides and antibiotic agents. Attention is usually focused on the respiratory tree because of a pain in the chest with a diagonal topography. Cough is an important and frequent symptom. The physical examination may reveal restricted dullness characteristic in its shape and localization. In fact it has been learned from

experience that the clinical manifestations exhibited by these patients are very atypical and meager. Very seldom will they lead to an accurate diagnosis.

One cannot overemphasize the frequent coexistence of an aseptic serofibrinous collection in the great pleural cavity which represents a reaction. The typical physical signs are then confirmed by the roentgenogram which reveals a diffuse opacity obliterating the costophrenic angle and extending into the axillary region superimposed on the opacity of the interlobar collection. Thoracentesis yields a straw colored fluid. If one fails to observe that the benign and atypical appearance of such pleurisy is not in harmony with the history and signs of infection one will erroneously attribute the whole pathological phenomena to this pleurisy. The diagnosis of interlobar pleurisy is essentially derived at from the roentgenogram as first pointed out by Lanos and American authors (Sante).

The organisms found in the collection yield as a rule a pure culture. *Pneumococcus* and *anaerobes* are and less frequently *streptococcus* and *anaerobes* are the causative organisms. The authors have never seen a tuberculous interlobar pyopneumothorax.

Much more interesting than the etiology and topography are the radioclinical forms of the condition which have been divided into three types calling for different diagnoses: the first is the pseudotumor type, which must be differentiated from the benign and malignant tumors of the lung; the tuberculous gummas solid cysts, and Asaman's collection; the second type is the interlobar pleurisy with bronchial fistula simulating an abscess of the lung; the third type of interlobar empyema is the pseudocyst. The diagnosis is possible only by reading the lateral film of the chest which reveals a shadow somewhat the shape of a football and crossing the lung field obliquely downward and anteriorly.

The authors point out that the interlobar empyema fail to heal spontaneously most of the time even with the use of chemotherapy and eventually become chronic. Theoretically thoracentesis exploratory or therapeutic, is to be vigorously condemned because of the chance of infecting the whole pleural cavity which is usually free. Thoracentesis may be practiced in certain instances when the interlobar collection as seen under fluoroscopy definitely comes in contact with the chest wall and when adhesions of the pleura leaves exist.

The pleurotomy is imperative and suffices in the great majority of the cases. It must be done in two stages, duplicating the technique of pneumotomy for abscess of the lung.

The prognosis of these interlobar empyemas must be considered as very good when adequate surgical drainage is carried out.

GERARD GAGNON M.D.

**Malignant Neoplasms of the Pleura** (In tema di neoplasie maligne pleuriche) GIULIO TOCINI Pol. clinico 223 med. 1947 54 300.

A malignant tumor of the pleura in a 70-year-old female is described by the author. The present ill

ness began about 4 months previous to hospitalization. The patient complained of a rise in temperature in the afternoon, perspiration, cough and profound asthenia. Later pain developed in the chest with a rise in temperature.

Physical examination revealed an emaciated female with a decreased chest expansion on the right. Auscultation of the lower right lung revealed absent breath sounds with a friction rub above. A slightly tender mass could be palpated in the right upper quadrant of the abdomen.

Röntgen-ray examination of the chest showed dense opacity at the base of the right side that extended up to the base of the scapula. A round shadow was seen in the upper hilus.

Thoracentesis on several occasions yielded only small amount of fluid having a specific gravity of 1.020, and containing few red cells and numerous lymphocytes.

The patient expired 4 months from the onset of the disease. At autopsy the right pleural cavity was found to contain a liter of hemorrhagic fluid which caused the left lung to press against the vertebral column. Towards the base of the right lung was found a nodular mass of a dark color. All lymph glands were enlarged.

Histological examination revealed the following substances to be dense fibroconnective tissue. Few nuclei were present in this tissue with finely distributed chromatin. These cells were arranged in tubular or canalicular form and were characteristic of endothelial cells. **ARTHUR I. CROSSLAND, M.D.**

## HEART AND PERICARDIUM

**Aortic Pulmonary Anastomosis for Pulmonary Stenosis.** WILLIS J. POTTS. *J. Thorac. Surg.* 1943, 17: 223.

Cyanosis due to certain types of congenital heart disease can often be relieved surgically. It must be demonstrated that the patient has an insufficient flow of blood to the lungs (as manifested by cyanosis), an increased red cell count, an increase of hemoglobin, a decreased oxygen saturation of the arterial blood, and a markedly decreased tolerance for exercise in order that the condition be suitable for surgery. In patients with typical pulmonary stenosis, as part of the syndrome of the tetralogy of Fallot, roentgenograms should reveal a fairly typical boot-shaped heart with a concavity in the region of the pulmonary conus on the left, a "pulmonary window" in the right anterior oblique and left anterior oblique views, and an absence of pulsations in the hilar regions of the lungs. Electrocardiographs must show a right axis deviation. In patients with tricuspid atresia the heart tends to be globular and slightly flattened on the right, in the region of the right ventricle. In such cases the electrocardiographs show a left axis deviation. A cyanotic child with a large heart or a prominent pulmonary conus with increased hilar markings or visible pulsations in the lung fields on fluoroscopy does not fall into the operable group.

Aortopulmonary anastomosis was performed on 26 patients with pulmonary stenosis and on 3 with tricuspid atresia. There were 4 deaths. While the most suitable age for operation is probably between 3 and 7 years, 13 children who were below 3 years of age were operated on. Successful anastomoses were also done on 2 children under the age of one year—one at 4 months and one at 6 months.

The results in the patients who survived surgery have been gratifying. The technique of the operation is given in detail. **SAMUEL KARY, M.D.**

**Resection of a Coarctation of the Aorta with Subclavian Aortic Anastomosis.** H. H. BRAUER, J. L. O'NEIL, and ELLIDA H. STOWER. *J. Thorac. Surg.* 1943, 17: 20.

The signs and symptoms of coarctation of the aorta form a well known syndrome the diagnosis of which is not difficult if the possible existence of the lesion is kept in mind. The prognosis is poor unless the patient is treated surgically. Approximately 75 per cent die before the age of 40. The condition may remain latent throughout life, death occurring suddenly from ruptured blood vessel or from conditions unrelated to the vascular anomaly. Cardiac insufficiency may occur rather suddenly and progress to complete decompensation and death. Chronic cardiac insufficiency may develop and lead to heart failure and death. Subacute bacterial endocarditis and mitral regurgitation may also occur.

A case is reported in which a 3 cm. segment of aortic aorta containing the coarctation was excised between clamps. When an attempt was made to suture the aortic ends together it was thought that the tension on the sutures was excessive and that it would be hazardous to complete the anastomosis. The proximal aortic stump was, therefore, closed, and the left subclavian artery was freed and divided between clamps at a point 4 cm. from the aortic arch. The distal subclavian stump was sutured, and the proximal subclavian stump was rotated caudad and was anastomosed to the distal aortic stump.

Long intestinal clamps were used to occlude the vessel ends while the anastomosis was being done. It was difficult to keep the cut ends of the vessels absolutely immobile in accurate end-to-end approximation. A clamp was, therefore, designed which would firmly grasp the aortic wall between parallel bars without crushing and which would permit the vessel ends to be accurately approximated to each other and immobilized.

The clamp devised is carefully described. It has been employed experimentally on 15 occasions, and has proved satisfactory. **SAMUEL KARY, M.D.**

## ESOPHAGUS AND MEDIASTINUM

**Esophagogastrostomy in the Treatment of Cardiospasm.** DAW C. CHU and CHARLES G. CHU, III. *Surgery* 1943, 3: 37.

The modern use of chemotherapeutic agents has allowed operations designed for the relief of cardio-

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spasm or achalasia of the esophagus to be accomplished with greater frequency and success. It is probable that the obstruction at the cardioesophageal junction is due to organic factors which are intrinsic in the cardia and to its autonomic nerve supply.

The authors operated upon 8 patients whose case histories are briefly summarized. Although a transpleural approach was used in 5 instances and a transabdominal approach in only 3, the latter approach is recommended. This conclusion is based on the fact that the esophagogastric junction is easily reached transabdominally and that in one patient an empyema complicated the postoperative course. In every case chemotherapy was employed in the early postoperative period.

Seven of the 8 patients were treated by an esophagostomy patterned after the Finney gastroduodenostomy. In the one remaining case the so-called Heinecke Mikulicz procedure was accomplished. This consists in the longitudinal incision through all the layers of the esophagus and stomach on either side of the cardioesophageal junction and closure by transverse suture of the incision.

In most of the patients some unfavorable symptoms referable to the upper intestinal tract persisted after operation. All were benefited by surgery and the function of the esophagostomy as shown roentgenologically was excellent in all of the cases. In 5 of the 8 patients there was an appreciable gain in weight. The esophagus returned to normal size in 5 of 7 patients in whom the esophagus was dilated and elongated decreased only slightly in one and did not change in size in the last.

The theory receiving most support at the moment is that surgery should be reserved only for those cases which are refractory to other forms of treatment. However, the authors suggest that many of these patients with cardiospasm should be operated upon earlier before irreversible changes in the esophagus occur.

**Bronchiogenic Cysts of the Mediastinum** HERBERT C MAIER. *Ann Surg.*, 1918 127 476.

A considerable number of bronchiogenic cysts occurring in the mediastinum produce symptoms of varying degrees of severity due mostly to pressure

upon the adjacent structures. These cysts which remain asymptomatic are found either on routine roentgenography of the chest or as incidental findings at autopsy. They are the results of abnormal budding or branching of the tracheobronchial tree. Continuity with the bronchial lumen may be lost in the event that the cells become separated from the parent structure.

The cyst is usually spherical or loculated and is lined by dilated columnar epithelium. Its wall contains mucous glands, cartilage, elastic tissue and smooth muscle. Secondary inflammation may destroy the epithelium so that its bronchiogenic origin may be difficult to prove.

In the absence of infection the symptoms produced by bronchiogenic cysts depend chiefly on the size and location of the mass. When secondary infection occurs the symptoms are those of an intrathoracic suppurative abscess. According to the degree of bronchial obstruction either obstructive emphysema or atelectasis may occur.

The roentgenogram of the chest may not demonstrate the cyst because it is usually hidden among the mediastinal densities. Occasionally an oblique film will demonstrate the lesion. The fact that bronchiogenic cysts most often are located in the posterior mediastinum serves to differentiate them from the more common dermoid cyst occurring in the anterior mediastinum. Cysts of bronchial origin may move and change their shape with respiration, which suggests their cystic nature and relationship with the tracheobronchial tree.

Since mediastinal tumors in general should be excised the failure to obtain a correct preoperative diagnosis is not necessarily a great disadvantage. The transpleural approach is recommended because of the access provided to both pleura and mediastinum. If complete removal of the cyst wall seems hazardous it is permissible to allow a portion of it to remain *in situ*.

Eight illustrative case summaries accompanied by excellent roentgenographic reproductions are presented to emphasize the clinical and pathological problems associated with the diagnosis and treatment of bronchiogenic cysts of the mediastinum.

ORVILLE F GRIMES, M.D.



# SURGERY OF THE ABDOMEN

## ABDOMINAL WALL AND PERITONEUM

**Incisional Hernia Repaired with Tantalum Gauze.**  
Preliminary Report. NELSON C. JEFFERSON and  
U. G. DAILEY. *Am. J. Surg.* 1948, 75: 575.

One case of surgical repair of a large incisional hernia with tantalum mesh is reported by the authors. The patient had a defect in the upper right quadrant measuring 6 by 8 inches. This was repaired in November 1946 and the authors report a satisfactory clinical result when the article was submitted for publication.

The authors report that tantalum was first used in surgery by Fulcher. The use of plates of tantalum in neurosurgery and for hernia repair has been reported but to the authors knowledge the use of mesh had not been reported when they completed this article.

Mesh can be used without causing tension on the supporting structures since it serves as a patch to cover the entire defect. Fibrous tissue encapsulates the gauze and becomes adherent to the surrounding fascia which produces a new wall of fibrous tissue.

W. FOSTER MONTGOMERY M.D.

**Cutis Grafts for Repair of Incisional and Recurrent Hernias.** HARRIS MAY and R. GAYLE SPANN. *Surg. Clin. N. America* 1945, 23: 57.

Occasionally certain hernial defects require considerable stronger tissue reinforcement. The authors employ cutis grafts and prefer them to fascial strips.

The graft is a full thickness of skin minus the epidermis. It is placed over the defective area and sutured to the peritoneum of the pubic tubercle one edge to Poupart's ligament and the other to the fascial covering of the conjoined tendon in the case of inguinal hernia. In incisional hernia the graft is sutured in position over the hernial closure under tension. The subcutaneous tissues are sutured down on the graft to enclose all dead space.

The main advantages of this type of repair are the availability of any size or shape of the tissue graft the strength in all directions of pull, and the stability of the buried graft.

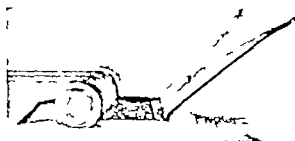


Fig. (May Spenn) A thin epidermis graft is raised and kinged. The cutis beneath is removed.

It is conceded that more experience is needed to make a final evaluation of this method, but it is believed that the cutis graft will take an important place in the repair of recurrent and incisional hernias.

STEPHEN A. ZIEGLER M.D.

**The Treatment of Peritonitis. A Review of 136 Cases.** RALPH H. LOE. *West. J. Surg.* 1948, 55: 300.

World War II provided the opportunity for this study of 136 cases of peritonitis due to abdominal gunshot wounds or gastrointestinal perforations from other causes. There were 30 deaths in the series and 16 autopsies were performed. In 8 cases the cause of death was the presence of missed bowel perforation. Two patients died of splenic hemorrhage, 1 from bile peritonitis due to a ruptured liver and 1 from the toxic effects of a necrotic segment of liver tissue which had been left in the abdominal cavity. The remaining 4 showed minimal peritoneal findings and died from distant toxic effects. These findings demonstrate the importance of complete inspection of the abdomen at the time of initial surgery and the importance of greater consideration of distant toxic effects of peritonitis in view of the better control of infection which is now available.

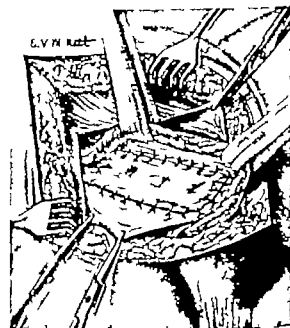


Fig. (May Spenn) The defective area is covered with a cutis graft, which is sutured to the peritoneum of the pubic tubercle, one edge to Poupart's ligament, the other edge to the fascial covering of the conjoined tendon, and the remaining edge is split at the point of emergence of the spermatic cord from the internal ring.

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The sulfonamides and penicillin modify previously accepted surgical principles but should not supplant good surgery. With modern chemotherapy there is seldom justification for delaying surgical intervention on the source of peritoneal contamination. Supportive therapy should be directed toward maintaining fluid equilibrium preventing peripheral vascular collapse and meeting nutritional requirements. Pulmonary edema and renal shutdown are to be avoided by the judicious use of fluids and blood. The use of the Miller Abbott tube has been a valuable means of controlling distention of the small bowel.

The combined use of surgical principles, adequate supportive measures, chemotherapy, and antibiotic therapy has resulted in a marked lowering of the mortality of peritonitis. The type of combined therapy used in this group of cases is discussed but recognition is given to the necessity of keeping an open mind in regard to the ideal chemist to be employed.

JOHN L. LINDQUIST M.D.

## GASTROINTESTINAL TRACT

**Roentgenographic Studies of the Gastrointestinal Tract following Section of the Vagus Nerve for Peptic Ulcer.** MAX RIVVO and IRVING A. SCHAUZ.  
*Englund J. M., 1948 238 496.*

The authors of this article are primarily interested in the roentgenographic study of gastrointestinal tract function following section of the vagus nerves for chronic intractable peptic ulcer. A brief review of the literature includes the work of Dragstedt, Grimson, Moore, and their respective coworkers. Attention is directed toward alterations in gastric motility following vagus nerve resection.

At the Boston City Hospital since December 1945 there were 33 patients who had bilateral vagus nerve resections. Twenty nine of these patients had trans thoracic vagotomies and 4 patients had trans abdominal vagotomies. All were studied repeatedly by roentgenography.

Twenty-one of these patients had had no gastric surgery prior to vagus resection. Three had had previous gastroenterostomies with persistence of ulcer symptoms. Of 5 patients who had had partial gastrectomies, 3 had developed intractable marginal ulcers and 2 refractory jejunal ulcers.

Results of a ray study reveal that in the early post operative stages there was a definite gastric dilatation and atonicity in most cases. Sluggish and arrhythmic peristalsis or lack of peristalsis was often associated with dilatation and atonicity. Emptying times were markedly delayed. These changes were distinctly less noticeable in patients who had had previous gastric surgery.

Follow-up studies showed a return toward normal gastric function within 6 months to a year after operation. Complete return to normal was not found however in only one case was the follow up period as long as 14 months. In this patient the stomach was slightly dilated with peristalsis of good quality and a 6 hour gastric residue of 5 per cent.

The operation was successful in promptly healing all of the ulcers. The results were especially striking in the patients with sternal and jejunal ulcers. Tenderness was not present on fluoroscopic palpation and no ulcer crater was demonstrable postoperatively. The small bowel was slow apparently mucosal pattern the motility was slow apparently because of delay in initial gastric emptying as the emptying time decreased the motility became normal.

EDWARD F. LEWISON M.D.

**Tetanus Infections as a Complication of Emergency Surgery on the Gastrointestinal Tract.** Exclusive of the Rectum (L'infessione tetanica quale complicazione di interventi di urgenza sul tubo gastro-enterico escluso il retto) GIUSEPPE SPADARO *Glor. Ital. chir. 1948 4 19*

From June 1940 up to January 1947 5 cases of tetanus following emergency operations on the abdominal portion of the digestive tract were encountered in the Pellegrini Hospital in Naples. In one case the infection developed following palliative intervention for perforated gastric ulcer in another following appendectomy for acute appendicitis in a third following laparotomy for intestinal occlusion resulting from volvulus of a loop of the small intestine on its mesentery. In 2 instances the infection developed subsequent to the Bassini herniotomy for incarcerated inguinal hernia. This number of tetanus cases following emergency operations on the gastrointestinal tract (exclusive of the rectum) comprised 18.5 per cent of all tetanus cases occurring in this hospital during this period (27 cases). In addition to the 5 cases reported the author has been able to find only 42 other such cases reported in the world medical literature.

The most important aspect of these cases of tetanus is of course the question of the source of the infection. Introduction of the tetanus bacillus on the surgeon's instruments is today pretty well ruled out. The catgut suture material has been pretty well proved to be free of tetanus spores however in one of the hernia cases a bit of catgut was discharged from the small local abscess which was opened shortly before the appearance of the symptoms of tetanus (no bacteriologic study). As regards the skin in the area of the incision its participation in the introduction of tetanus spores can of course never be entirely excluded despite the most careful disinfection of the area and despite the utmost care in fixing the sterile sheets or towels to the edges of the incisions. The possibility of infection is especially great in the patients who live close to the soil. Two of the patients in this material were farmers and one was a carter. The activation of a latent focus of tetanus in the tissues of the patient himself may be caused by the trauma of the operation or by the original inflammatory or other condition for which the patient was operated upon however the author does not raise this possibility for any of the cases here reported. Lastly there remain the possibility of the content of the intestine as the source of the infection.

tion. Of course the normal intestinal mucosa is admitted to be (in all probability) an insuperable barrier to the tetanus bacillus; however, in the case of perforation of gastric ulcer the patient had eaten shortly before the operation and could have ingested some tetanus spores which might have escaped the gastric succus and thus gained entrance to the peritoneal cavity, and in the case of volvulus the symptoms of obstruction had started 6 days before the onset of the intestinal obstruction, and this would have been just enough time for alterations in the involved intestinal mucosa to have made it a possible portal of entry. However, the number of cases are too few to permit of definitive conclusions.

In the matter of mortality 4 of the patients developed symptoms of tetanus within 3 days after the operation, the process ran an acute course, and despite heroic dosages of antitetanic serum, death resulted in all of these cases. In the fifth case, the case of volvulus, the intestine was not opened, the tetanus did not appear until 3 days after the operation, and the patient, under treatment with serum consisting of 50,000 I U given intraspinally, 20,000 I U given intravenously, and 20,000 I U given intramuscularly daily, recovered from the attack.

The author concludes from his personal experience with the material here reported, and from his study of the literature that: the so-called traumatic tetanus the prognosis is much graver than in the other forms of this infection commonly encountered.

JOHN W. BREENA, M.D.

**Treatment for Gastric Ulcer.** SAMUEL I. M. RUSSELL and MARK L. WELCH. *J Am M Ass* 94:8 36 748.

Benign gastric ulceration was diagnosed in 800 patients seen at the Lapey Clinic, Boston, during the year period from 1936 to 1945. During the same period approximately 8,000 patients with peptic ulcer were treated; hence the ratio of duodenal to gastric ulcer was found to be 9:1, a finding which compares favorably with the statement of Lusterman and Balfour that duodenal ulcer is ten times more frequent than the gastric variety. In 31 of the 800 cases diagnosed as benign gastric ulcer, partial gastric resection was carried out, and pathologic study revealed carcinoma in 26—a diagnostic error of 9.8 per cent. The total incidence of proved malignancy for the entire group of patients treated medically and surgically was 26 (3.3%) which is assuming the unlikely possibility that none of the patients treated medically proved later to have cancer. Many of the patients operated upon were submitted to resection because of failure of the lesion to heal, i.e. because carcinoma could not be ruled out. Seventeen of the 26 patients had been under medical treatment for a month or longer, a period of observation which the authors consider to be too long. Since a benign ulcer of the greater curvature is an extreme rarity it should not be treated medically. Further confusion in diagnosis is caused by the apparent favorable response of malignant ulcers to a medical ulcer regimen; the

lesions appear to become smaller on roentgenologic study, but never quite disappear.

Gastric ulcer is four times more common in men than in women, and the majority of cases in the authors' series occurred in the fifth decade or later, the so-called cancer age. Gastric symptoms of benign and malignant ulcers are likely to be similar; weight loss is a prominent feature of both groups, and 80 per cent of patients with distress arising from malignant lesions were relieved by food or alkali. Acid determinations are surprisingly parallel in both groups: free hydrochloric acid was present in patients with malignant lesions and anacidity occurred in those with benign ulcer and vice versa. Malignant ulcerations were found to be greater than 2.5 cm. in 61.5 per cent of the cases, but mere size is not a criterion for differentiation since small ulcers occurring anywhere in the stomach often were found to be malignant. Lesions arising in the prepyloric area, the greater curvature, and the cardia should particularly be suspected of malignancy.

The authors state that it is their considered opinion that the treatment of gastric ulcer is primarily surgical, and that a trial on medical management is possibly indicated only in a few cases of acute ulcer. The latter should be observed in the hospital and surgery should be resorted to promptly in the event of nonhealing or of failure of the ulcer defect to disappear during a short period of hospitalization. Surgical results of partial gastrectomy were in general considered to be excellent and there was but one recurrence in an uncomplicated patient, in the series of 105 benign ulcers subjected to operation.

WAYNE F. CAMERON, M.D.

**Peptic Ulcer.** HAROLD LINCOLN THOMPSON. *J Am M Ass* 94:8 36 757.

The author presents a review of the complications of peptic ulcer, with particular reference to pyloric obstruction, acute hemorrhage, and acute perforation into the free peritoneal cavity. Indications for surgery in peptic ulcer are largely confined to the complications of the disease and range from relative indications for intervention as in the case of intractability, or possible malignant degeneration to absolute indications as in the case of acute perforation. It is with the latter that the article is primarily concerned.

Obstruction of the pyloric outlet is of two types: (1) an acute transitory obstruction due to spasm and edema and usually associated with an active ulcer located at or near the pylorus, and (2) chronic obstruction resulting from organic cicatricial stenosis. In either case the treatment begins with decompression by continuous suction and the correction of systemic factors such as hypoproteinemia, avitaminosis, chloride depletion, anemia, and hyperacidity. Antispasmodics are of value in the spastic type of occlusion. The two types of obstruction may be distinguished by their clinical course and by the response to treatment. In the acute transitory variety medical treatment is warranted for so long

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as relief is obtained. In the chronic stenosing obstruction surgical intervention is ultimately required and should be applied before the patient is nutritionally depleted. Subtotal gastrectomy by the Polya Hofmeister technique is a satisfactory procedure. Vagotomy with gastroenterostomy has given good results, but it is too early to critically evaluate the operation.

Peptic ulcer is the cause of bleeding in approximately one-half of all cases of hematemesis. Eighteen per cent of deaths resulting from peptic ulcer are due to hemorrhage. Clinically, two types of this complication are recognized. First there is a large group in which the hemorrhage is minor moderately severe, or remittent, and in which there is either a favorable response to medical management or a sufficient interval between recurrences that elective surgical treatment can be undertaken. Second there is a smaller group in which an acute massive intractable hemorrhage occurs and eventually leads to a fatal termination. Surgical intervention during active bleeding in this group may prove a lifesaving measure.

The highest degree of clinical judgment and operative skill are required in handling cases of severe hemorrhage; there are no positive means during the early stages of bleeding of determining which patients will respond to medical treatment and which ultimately will require surgical intervention. Yet to delay beyond 48 to 72 hours greatly increases the mortality in those requiring operation. In the selection or rejection of patients for surgical treatment the following factors must be considered:

1. *Age of patient.* Probably age alone is the most important prognostic point in ulcer hemorrhage. In patients younger than 45 years the mortality with conservative treatment is less than 5 per cent. In patients older than 45 the mortality is 30 per cent. Hence Finsterer's rule of operation during the first 48 hours should be applied to good risk patients in this group. In surgery after 48 hours the 30 per cent mortality rate again obtains.

2. *Advance knowledge of the presence and location of the ulcer.* Is of value in locating the source of the bleeding; those patients who are known to have chronic penetrating ulcers in the region of the pancreaticoduodenal artery are likely candidates for immediate surgery.

3. *Recurrent hemorrhage* indicates an increasing danger of fatality, particularly as the patient approaches the critical age. It must however be remembered that the initial hemorrhage may be fatal.

4. *Severity of hemorrhage* as manifested by vomiting of gross blood, tarry stools, weakness, pallor, dyspnea, tachycardia and fall in the blood pressure requires consideration for urgent surgery. The hematocrit is the best index of blood loss. Evidence of continued bleeding is found if after multiple transfusions the systolic pressure remains below 90 and the pulse above 130. Since some patients respond promptly to conservative treatment the best criterion for surgical intervention is found in the patient's response to treatment while he is given half hourly checks on the pulse and blood pressure. It should be kept in mind that the decision should be made during the first 48 hours.

5. *Associated disease* (arteriosclerosis, hypertension and coronary sclerosis) within reasonable limits, is an absolute indication for surgical treatment since pronounced secondary anemia superimposed upon these states leads to anoxia, hypoproteinemia and hyperazotemia, which are more likely to lead to death than a skillful operation to control the bleeding. Proper surgery is directed at adequate visualization of the bleeding point and ligation of the vessels in healthy tissue before they enter the ulcer bed. When possible the ulcer may be excised, subtotal gastrectomy is carried out after bleeding has been stopped.

Acute perforation is the most sudden severe and disabling complication of peptic ulcer and save for the forms frustes type, is in most quarters held to be an absolute indication for surgical intervention. In the typical case in which severe pain, boardlike rigidity of the abdomen, and shock are present there is little difficulty in diagnosis. For a further reduction of mortality in this complication certain details of surgical treatment are important:

1. The use of spinal anesthesia is generally preferred in patients who are in good condition. In poor risk patients endotracheal inhalation anesthesia with nitrous oxide or cyclopropane is preferable. Curare assists in securing relaxation. Field block may be employed in very poor risk patients.

2. Transverse or oblique incision is preferred to the longitudinal type as the wounds are more readily closed and early ambulation may be employed.

3. Simple closure of the perforation reinforced by a tag of omentum is the only operative procedure indicated. Gastric resection should be reserved for a later stage when the patient is in better condition.

4. No drainage of the wound is done; rather the abdomen is tightly closed after a thorough aspiration.

5. The use of sulfonamides locally has generally been abandoned in favor of parenteral sulfonamides or antibiotics before and after surgery.

6. Postoperatively continuous gastric suction, adequate parenteral fluids and early ambulation are emphasized.

WATKIN F. CAMERON, M.D.

**Peptic Ulcer following Gastric Resection (L. ulceri peptica post resectione gastrica).** GIOVANNI RINDONE. *Polislinico*, sez. chir. 1947 54: 201.

The author presents a tabulated review of 14 cases of peptic ulcer following gastric resection, showing the type of primary operation, the signs leading to reoperation, the radiologic findings, the type of surgery performed and the pathological findings. These cases were found among a group of approximately 1,500 cases of gastric resection making up 0.8 per cent of the total.

The author then gives an exhaustive review of the literature including the pathogenesis, pathology

symptomatology complications, diagnosis prognosis and therapy. The following points are discussed.

Surgery was resorted to in all cases of marginal ulcer. The operative procedure followed was strictly along functional lines to assure proper emptying of the gastric stump and duodenum and eliminate factors tending to cause hypersecretion. The breakdown depended upon the type of anastomosis performed during the primary operation. Whenever the pyloric portion was found it was removed, if possible. The ulcer bearing area was always resected. Sometimes the operation was performed by resecting the ulcer bearing area in block, at other times this was done by first breaking down the anastomosis. When a jejunojejunostomy was encountered it was resected and the anastomosis made beyond this portion. The aim is to leave a third of the original stomach, but this is difficult to evaluate at times since the size at the primary operation is not known. The anastomosis was transmesocolic in all except one case (antecolic) the latter was done because of a narrow mesocolon. In 2 cases of colic fistula the viscera were separated and the opening in the colon was closed. This was followed by ample gastric resection. No mention is made of vagotomy. LUCIAN J. FRODOTT, M.D.

#### Further Observations on the Treatment of Bleeding Peptic Ulcer. CRAMTON W. HOLMAN, *Surgeon*. 945, 3, 405.

During the period from 1932 to 1939 patients admitted to the surgical service of the New York Hospital because of hemorrhage from peptic ulcers were treated with a more or less standard conservative regimen which consisted of complete bed rest, nothing by mouth, adequate sedation and supportive parenteral fluids until the bleeding had ceased. Of a total of 161 patients so treated 5 continued to bleed after prolonged therapy and were operated upon as a last resort. During the period 21 patients died, a mortality rate of 13 per cent.

With a reevaluation of the foregoing statistics in 1940 it was determined that two particular groups of patients showed a distinctly poor prognosis under the conservative type of treatment: (1) those who failed to improve within from 24 to 48 hours after they had been placed on a strict medical regimen (48% of these would have died had conservative treatment been continued) and (2) those who suffered the first hemorrhage while under a strict medical regimen for a heretofore uncomplicated ulcer. As had been noted by others, it was found that the age of the patient had a significant bearing on the prognosis. In patients under 30 years of age the mortality was 6 per cent, in contrast to the 30 per cent in those 50 years and older. Hence it was decided to operate immediately on any patient who fell into either of the two groups described, particularly if the patient was over 40 years and if his condition in any way warranted the risk.

During the period from 1940 to 1946 when the newly instituted regime was followed the mortality

rate was reduced to 5 per cent. Among a total of 206 patients treated because of bleeding there were 11 deaths. Nineteen patients were operated upon during active bleeding and 4 deaths ensued. Eighty-four patients were operated upon after recovery from bleeding with a 3.6 per cent mortality and 66 were discharged from the hospital without operation.

The results of a 5 year follow-up of the patients hospitalized for bleeding peptic ulcer are shown on the following table.

Treatment	Number	Result	Number
No operation	1	Asymptomatic	33
		Bleeding	66
		Pain	4
		Death from bleeding	1
Gastroenterostomy	1	Asymptomatic	1
		Bleeding	1
		Pain	
		Death	
Pyloroplasty	1	Asymptomatic	
		Bleeding	
		Pain	
		Death	
Gastric resection	13	Asymptomatic	4
		Bleeding	
		Pain	1
		Death	

The success of this treatment the author emphasizes, depends on (1) early recognition of patients who will not respond to conservative treatment and (2) operation on these patients as soon as possible after the onset of bleeding preferably within 48 hours.

Gastric resection is the operation of choice both to insure the immediate control of bleeding and a satisfactory permanent result. Lesser procedures, not including vagotomy (which is not discussed) are not advisable and give a very much higher incidence of recurrent bleeding. WAYNE F. CANNON, M.D.

#### Malignant Disease of the Stomach Simulating Gastric Diverticulum. CHARLES D. ARMSTRONG and DWIGHT L. WILBUR. *Med. Cl. Y. (Surgery)*. 945, 3, 216.

True gastric diverticula are relatively uncommon. The majority occur in females and most diverticula give symptoms in the fourth and fifth decades. They may be classified into (1) true or congenital diverticula—in which the walls contain all three mucosal and muscular coats and (2) acquired or false diverticula—in which one or more of the gastric coats is thinned or broken as the result of disease or unusual strain. These latter are more frequently found than the former and may be further divided into (a) those

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caused by pulsion (intraluminal pressure acting on a gastric wall impaired by disease) and (b) those caused by traction through the attachment of the gastric wall to external structures as the result of a pathological process. The etiology of the condition is not known although many theories have been proposed.

Outpouchings of the gastric wall occur less frequently than those elsewhere in the alimentary tract which appear in order of descending frequency, in the colon as Meckel's diverticulum in the duodenum pharynx esophagus stomach and in the jejunum.

The congenital type of diverticula are found principally on the lesser curvature of the stomach toward the posterior wall within a few centimeters of the cardia. The acquired diverticula are more diffuse in their distribution. The diverticula vary in size some being as small as a pea others as large as a plum and are connected to the body of the stomach by a neck of pedicle of varying lengths. In most diverticula the mucous membrane is intact, and acute diverticulitis gangrene and perforation have not been described. Adenomas myomas sarcomas, carcinomas and precancerous lesions may be found in the wall of a diverticulum.

The majority of gastric diverticula are asymptomatic, but they may in themselves produce symptoms as the result primarily of gastrospasm. The symptoms in order of frequency, are (1) pain most frequent in the epigastrium and aching or burning in character (2) belching and abdominal bloating (3) nausea and vomiting (4) dysphagia and (5) bleeding which may occur from erosion of the mucous membrane.

The chief diagnostic aid is roentgen examination with opaque meal. The diverticula are often best seen in the recumbent left oblique position which places the sac in dependency. It may be easily overlooked in the anteroposterior position. Gastroscopic examination is also a diagnostic aid, the diverticula appearing as a circular hole lying in normal mucosa without infiltration and separated from it by sharply defined margins. Difficulty however, is encountered in deciding whether the diverticulum visualized in roentgenograms by gastroscopy or at laparotomy is actually the cause of the patient's symptoms.

In the asymptomatic majority of cases of diverticulum of the stomach no treatment is required if coexistent malignant disease can be excluded. In symptomatic cases of a mild nature a medical routine of low residue diet, antispasmodics, antacids and sedation usually is satisfactory. If medical treatment is not successful then surgical excision is the treatment of choice.

The surgical approach to the cardiac end of the stomach may be either through the abdominal or transthoracic approach.

The authors report 2 cases of simulation of diverticulum of the stomach by malignant disease.

ELY ELLIOTT LAZARUS, M.D.

**The Importance and Significance of the Lack of Leukocytosis in Gastric Cancer and Changes in the White Count after Gastric Resection** (In the White Count after Gastric Resection (In the White Count after Gastric Resection) *Importanza e significato della mancanza di leucocitosi nel carcinoma gastrico e comportamento della serie bianca dopo resezione gastrica*) GIACOMO BOCCUTTI and WALTER PAOLINO *Minerva med. Tor 1948, 39 245*

A series of blood counts taken at frequent intervals in patients with tumors of the various portions of the stomach and also of the esophagus and the duodenum liver extrahepatic biliary ducts, and the large intestines demonstrated to the authors the great role which the stomach plays in leukopenia. The importance of the antipernicious factor in the genesis of digestive leukocytosis has also been clearly shown.

In a number of patients who underwent gastric resection, considerable changes were found not only in the red but also in the white count which demonstrated the role of the stomach in the regulation of hemopoiesis. This regulatory mechanism is not confined to any small portion of the stomach the entire digestive tract participates in it.

Leukocytosis a normal white count or leukopenia may be found in patients with cancer of the stomach. Thirty-seven and one-half per cent of the patients with a tumor in the region of the cardia or fundus had a white count of over 8,000 another 37.5 per cent had a count below 6,000 and 8,000 and 25 per cent had a count between 6,000 and 8,000 and three tenths per cent of the patients with tumors in the region of the antrum had a white count over 8,000 23.1 per cent had a count between 6,000 and 8,000 and 61.6 per cent had a count below 6,000 and 8,000.

The effect of cancer of the stomach on the red and white blood counts is ascribed by some writers not to a direct action but to a cancerogenic toxic effect, hemorrhage digestive disturbances or osseous metastases.

Absence of digestive or postprandial leukocytosis is not characteristic of gastric carcinoma because it occurs also in catarrhal gastritis, pernicious anemia, simple gastric achylia, and cachexia caused by tumors in other locations in the stomach.

Absence of leukocytosis was noticed by the authors in 80 per cent of the patients with tumors in the duodenum 42.9 per cent of those with tumors in the biliary tract, 34.6 per cent of those with neoplasms in the large intestines and 30 per cent of those with tumors in the liver.

Of 150 patients with ulcers of the stomach 21.7 per cent had a white count of over 8,000 53.3 per cent a count between 6,000 and 8,000 and 20 per cent a count less than 6,000. Thirty-one patients were subjected to a gastric resection and after the operation 6.4 per cent had a count of over 8,000 38.7 per cent had a count between 6,000 and 8,000 and 54.9 per cent a count of less than 6,000.

In a great many instances the leukopenia found in patients with cancer of the stomach was accompanied by a relative lymphocytosis.

All the aforementioned data demonstrate the great effect of the stomach on leukopoiesis. Castle's factor evidently plays a great role in the genesis of postprandial leukocytosis. Gastric resection by removing a part of the organ which participates in the regulation of hemopoiesis causes alterations in the white as well as the red blood count.

JOSEPH K. VILKAS, M.D.

#### Postoperative Hypoproteinemia after Gastrectomies. BJA VEILSTRØM. *Acta Chir Scand* 94 of Supp 30

A short review of the literature on hypoproteinemia is presented. Anesthesia, anoxia, shock, hemorrhage, and electrolyte abnormalities are factors in the development of hypoproteinemia. Anemia will be more pronounced during local anesthesia, spinal anesthesia, and cyclopropan narcosis. The author's investigation was carried out to determine the degree of postoperative hypoproteinemia after gastrectomy and whether the concentration of serum protein showed a correlation with the occurrence of complications. Eighty-five cases of gastric or duodenal ulcer and 38 cases of cancer of the stomach besides normal material and material for control and comparison were used in this study. All patients with ulcer except 2 were treated by resection of the stomach and about one half of the stomach was removed. Either Polya operation with retrocolic, terminolateral anastomosis or Moynihan's operation with antecolic, terminolateral anastomosis and suture of the gastrojejunostomy in the latter was used. The anesthesia employed was either spinal anesthesia or ether narcosis. Twenty-five of the patients with cancer were operable and 3 were inoperable. All of the patients were given from 1 to 1.5 liters of normal saline solution subcutaneous during the operation and after the operation, and drop enemas so that they received from 3,000 to 4,000 c.c. of liquid in the first 24 hours. In the non-complicated cases the patients were given a teaspoonful of liquid by mouth on the first day after the operation and afterward in steadily increasing quantities with the addition of soda water and broth. On the third day the patient usually got two rusks, and on the fourth day also fish balls. Afterward they gradually received a diet of minced meat and mashed potatoes and vegetables. On the third day after the operation an enema was given. The loss of protein through the urine is not to be reckoned with according to the findings. The routine examination of the feces for blood was therefore discontinued.

Eighteen patients examined showed no postoperative variations in chlorides or alkali reserve outside the normal limits. The average amount of serum protein in 30 healthy men and 30 healthy women was equal for the men and women, namely 7 gm per cent, and the nonprotein nitrogen was found to be practically equal for men and women, average 3.35 mgm per cent. The average hematocrit value was 43 per cent for men and 40 per cent for women. The serum protein in 61 patients with uncomplicated

gastric or duodenal ulcer was 0.3 gm per cent lower than in the normal material. Variations for the nonprotein nitrogen and hematocrit were small. In 27 (all men) of the 61 patients with uncomplicated ulcer who had been subjected to gastrectomy the operation and the postoperative course were free from complications. The content of serum protein fell on the third day after operation to 84 per cent of the average preoperative value. By the fifteenth day it rose to 92 per cent of the preoperative value. The course of the nonprotein nitrogen was the opposite of that noted for the serum protein and the hematocrit. The nonprotein nitrogen rose to a maximum on about the third day and fell to the preoperative value on about the tenth day after operation. It appeared that the principal cause of postoperative hypoproteinemia after uncomplicated gastrectomy was hemorrhage. The serum protein and hematocrit values decrease a little after tapping of the blood. Three patients with hematemesis and melena were examined.

An experiment was performed to investigate if the preoperative intravenous infusion of plasma would prevent the fall in serum protein after gastrectomy. Four patients were given plasma transfusions of 800 c.c. about 6 hours after the operation. It was found that one can prevent the postoperative fall in serum protein after uncomplicated gastrectomy for ulcer by the administration of 800 c.c. of plasma intravenously after the operation. Experiments show that the transfusion of 900 c.c. of blood after the operation can prevent the postoperative fall in the hematocrit value which always occurs after an uncomplicated gastrectomy. It was also seen that the postoperative fall in serum protein was prevented. Thus, the rise in serum protein and hematocrit values coincides with the restitution of the intestinal functions. The serum protein in grams per cent in patients on a diet cure for gastric or duodenal ulcer was investigated before and after 1, 2, and 3 weeks following the commencement of the cure treatment. Examination revealed a very slight fall in the first and second week of the cure treatment while in the third week the figures were practically the same as those noted before the treatment began. Therefore, the postoperative hypoproteinemia after uncomplicated gastrectomy for ulcer seems to be due mainly to the loss of blood caused by the operation and in some degree to postoperative paralysis of the intestine. In the case of uncomplicated gastrectomy for ulcer no postoperative hypoproteinemia was noted. Cases in which the development of hypoproteinemia was prevented by the transfusion of plasma or blood did not reveal that this procedure had any influence on the postoperative course. The hypoproteinemia regresses spontaneously as the patient recovers after the operation and the gastrointestinal functions are resumed. The serum proteins reach the preoperative value in 2 weeks after the operation.

Transfusion of whole blood is therefore the most suitable procedure. Transfusion of 450 c.c. of blood is not sufficient in uncomplicated cases to prevent

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entirely the postoperative fall in serum protein and hematocrit. There were 27 complicated gastrectomies for ulcer. Here again it appeared that the most frequent and most important cause of postoperative hypoproteinemia was hemorrhage.

An increased propensity to edema with distinct clinical symptoms was noted in 3 cases. In 13 cases it was found that the postoperative hypoproteinemia was below the so-called edema threshold.

There were 4 cases of disturbance of the process of wound healing. Hypoproteinemia is an important contributory cause of wound disruption. Control examination of the hematocrit ought to be made before, and every day after the operation until the value has come up toward the normal and the patient is out of danger.

There were 38 patients with cancer of the stomach, 28 men and 10 women. In 25 cases gastrectomy was performed. In 13 the condition was inoperable. The average values for serum protein and hematocrit in patients with cancer of the stomach are lower than the average values found in patients with uncomplicated gastric ulcer. Patients with cancer of the stomach were found to have, in general, a lower concentration of serum protein than patients with gastric ulcer and a concentration which was very much lower than that of healthy individuals. The postoperative fall in hematocrit was relatively less and the rise in nonprotein nitrogen relatively more after the operations for cancer of the stomach.

Laparotomy in itself had little influence on the serum protein as shown in 7 cases of exploratory laparotomy in inoperable cancer of the stomach. In these cases it was probably the laparotomy with the resultant gastrointestinal paralysis as well as the reduced capacity for the new formation of serum protein that was the chief cause of the hypoproteinemia. Here again, it was assumed that hemorrhage was the principal cause of postoperative hypoproteinemia after gastrectomy. Patients operated upon for cancer of the stomach seemed to have less capacity for the regeneration of serum protein than patients operated upon for gastric ulcer. A simultaneous pronounced fall in the serum protein and rise in the hematocrit and nonprotein nitrogen values after the operation is a very bad prognostic sign.

RICHARD J. BROWNE, JR., M.D.

**The Probable Nature of Intestinal Infarction with out Vascular Lesions** (Sulla probabile natura dell' infarto intestinale senza lesioni vascolari) ALDO GRECO. *Gior Ital chir.*, 1947 3 637

The author describes a case of intestinal infarction without vascular lesions. An uncertain diagnosis of intestinal obstruction or intestinal infarction had been made. At operation, a loop of small intestine measuring about 110 cm. was found 40 cm from the ileocecal valve. It was dark red in color with hemorrhagic spots disseminated throughout. The corresponding mesentery was of a similar appearance. At the base of the involved mesenteric wedge was a group of enlarged lymph nodes, one of which was as

large as a big nut and covered with necrotic serosa. A white creamy substance having the macroscopic appearance of tuberculous pus was expressed. The enlarged glands were removed. On returning to the involved intestine it was found to be in the same condition even though about 10 minutes had elapsed. At this time 1 c.c. of adrenalin 0/00 was injected subcutaneously. In about one minute the arterial pulsations reappeared and the color improved. The postoperative course was uneventful.

The histologic study revealed amorphous detritus with some degenerating lymphocytes. No acid fast bacilli were found. Roentgenograms of the chest revealed a bilateral parenchymal infiltration in the subclavicular region with incipient resolution.

The literature is reviewed and various theories as to cause of the condition are discussed such as arterial spasm with local ischemia, infection and the theory of Gregoire who believes the hemorrhagic phenomena of the intestine to be due to local anaphylactic shock.

The author suggests, from a purely pathogenetic point of view, that this lesion is similar to other conditions such as retractile mesenteritis, chronic terminal ileitis and incapsulating peritonitis. All of these have as a common basis plasmorrhagic phenomena of different intensity and duration. He would regroup these as a single nosological entity called enteromesenteric diseases with altered capillary permeability. In the author's case it would be considered as an acute manifestation—in other similar conditions as a more chronic manifestation.

LUIGI J. FROST, M.D.

**A Critical Consideration of the Methods of Operation for Carcinoma of the Rectum** (Sul metodo di operazione del carcinoma del retto. Considerazioni critiche) A. CIMINATA. *Gior Ital chir.*, 1948 4 1

The most important advance in the surgical treatment of rectal cancer, following Lisfranc's simple perineal amputation of the rectum was abdominal colostomy. This procedure has warranted its popularity by detoxifying the patient by relieving him of the fecal stasis in cases of stricture. The artificial anus also sets the lower intestinal tract at rest and thus helps to relieve the sufferer of the edema, irritative inflammatory processes and necrotic changes in and about the tumor itself.

The author believes that the colostomy should be extended even to the cases without stricture. The tendency has, of course, been to use ever more radical measures in the hope of obtaining lasting cure of the patient; however this consideration has always been limited by the operative mortality. Kraske extended the perineal procedure to include the removal of parts of the sacrum as far as the third sacral foramen and later this was extended to include the entire width of the sacrum to the level of the third sacral foramen; however in addition to the local disadvantages such as perineal hernia, the lack of access to the upper abdominal cavity prevented the approach to the malignant process and management of its dis-



semination upward along the course of the superior hemorrhoidal artery. The next most common route of dissemination is downward towards the perineum; this is best managed by removal of presacral connective and lymphatic tissues by means of a Kraske operation or one of its modifications. The English surgeons (Lockart Mummery Gordon Watson) follow J. Miles turned away from the abdominoperineal method and clung to the definitive colostomy. This was done both because of the lower operative mortality and because of the trouble experienced with the newly formed perineal anus. However when the perineal anus is properly formed the patient can be educated to recognize the defecation impulse and the regular bowel function which is very

close to normal. The perineal anus has, therefore, lost much of its terror.

The author on the basis of his personal experience prefers the abdominoperineal method with the definitive abdominal artificial anus for the carcinoma situated high up in the sigmoid. However for tumors in the ampulla of the rectum and in the anal canal, which comprise about 10 per cent of all tumors in this region, he prefers the Kraske amputation with the perineal anus.

JOHN W. BAZZEVILLE, M.D.

War Wound of the Rectum and Anal Sphincter  
WILLIAM S. MCCORM. *Surgery* 1943, 23: 653

Forty-one patients with wounds of the rectum and anal sphincter were treated. All except one of the

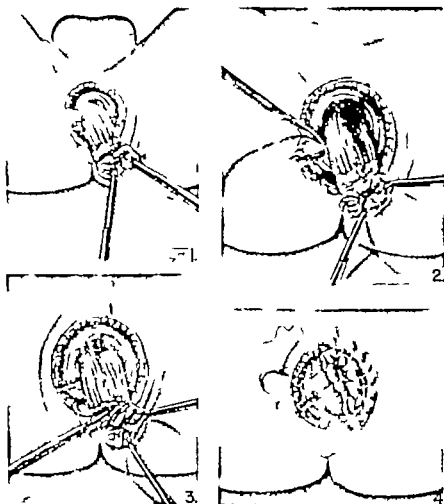
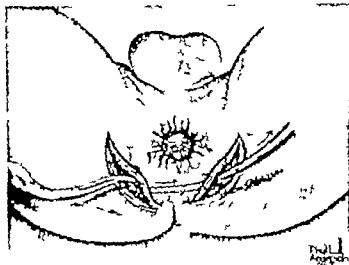


Fig. (McCorm.) Plastic repair for anal sphincter defect. A circular incision has been made around the mucocutaneous border of the anus and the mucous membrane of the rectum dissected upward for distance of about 3 inches. Mucous membrane, including the scarred area is drawn down and. The scar is excised from the exposed anal sphincter. 3. Sphincter muscle has been repaired. Rectal mucous membrane is cut across above the scarred area. 4. The remaining mucous membrane is sutured to the skin to cover the repaired sphincter.

Fig. 2 (McCune) Fascial sling plastic repair for complete anal incontinence. 1 Short incisions have been made on each side of anus posteriorly to expose the lower edge of the gluteus maximus muscle. A strip of ox fascia is pulled through the posterior subcutaneous tunnel from one incision to the other. 2 The end of the strip is drawn back through the anterior subcutaneous tunnel passed through a portion of the gluteus muscle, and tied to the distal end of the same strip, to form a sling around one side of the anus. 3 Beginning at the opposite incision a second strip of fascia is passed in the opposite direction and tied in a similar way to complete the circle. The skin is closed with silk.



wounds were due to gunshot from the enemy the majority being caused by shell fragments or machine gun fire. All of the patients were between 20 and 36 years of age. In most instances no definitive treatment for sphincter incontinence or external rectal fistula had been given prior to transfer of the patient to the Walter Reed General Hospital although in many instances skin grafts, secondary wound closures and rectourethral fistula repairs had been performed. One patient had had two previous attempted closures of a large external rectal fistula. The average lapse of time between the time the patient was received and the first definitive treatment in this hospital was 10 months. This length of time is explained by the fact that most cases were complicated by other conditions which received treatment priority. These included 11 rectovesical or urethral fistulas and numerous instances of sciatic nerve injury, perforations of the colon and small bowel, and compound fractures of the pelvic bones. All patients had had débridement of the wounds and most of them a temporary sigmoid colostomy at the time of injury. Most of them had had local application of sulfanilamide crystals and shock treatment in the form of plasma and blood transfusions.

The classification and treatment of these 41 rectal war wounds and the evaluation of the results of the

various operative procedures employed have convinced the authors of several facts (1) sphincter muscle exercises are of great value in improving anal sphincter power, (2) the best operative results are usually obtained in the cases in which torn muscle ends can be approximated, even though not perfectly (3) the Stone fascial plastic operation has a definite place in the treatment of such patients if the sphincter ends cannot be found (this operation has given enough control to restore many men to fairly normal lives) and (4) when no repair of sphincter power can be devised an abdominoperineal resection is probably the procedure of choice. It must be remembered, however that this precludes any later repair based upon future developments in rectal surgery.

CHARLES BARON, M.D.

#### LIVER, GALL BLADDER, PANCREAS, AND SPLEEN

Preoperative and Postoperative Treatment in Hepatobiliary Disease. B. O. C. FRIEDMAN. *Surg. Clin. N. America* 1948 23 493.

For the preoperative treatment of hepatobiliary disease the author recommends the intravenous injection of a mixture of atropine sulfate, morphine, and ephedrine. The judicious use of local measures

such as the application of heat or cold, the rehabilitation of fluid balance, liver glycogen, proteins and electrolytes, the combating of acute liver edema by the use of 20 cc. of a 50 per cent dextrose solution, prophylaxis against cholemic hemorrhage by the use of vitamin K, calcium and vitamin C, and surgical measures in cases of intractable jaundice. Electrocoagulation is recommended and the procedure is described in detail. Postoperative therapy is directed toward combating shock, the respiratory state, reduced blood pressure, peripheral circulatory failure, peritonitis, hepatic insufficiency, coma, hepaticum and venous thrombosis.

The advantages of mucoclasia, the correct method of employing electrocoagulation and its place in gall bladder surgery form an integral part of the present paper. **STEPHEN A. ZILMAN, M.D.**

**The Cholecytic Syndrome and Lymph Gland Calcification of the Hilus of the Liver (Syndrome colecyctica, calcificatione linfoglandulare del'ilo epatico) PAPER (J. Amer. med. Assoc. 1948, 39, 20)**

The results of x-ray studies of gall bladder disease are stressed by the author. Certain syndromes can be easily misinterpreted if the diagnosis is based only on clinical and laboratory findings.

The value of roentgenologic studies is illustrated by the report concerning a female patient, aged 35, admitted with complaint of attacks of pain in the epigastric region. There was tenderness in the right upper quadrant on palpation. X-ray studies demonstrated a group of calcified nodules at the height of the transverse apophysis of the second lumbar vertebra. Cholecystography showed that the shadows were located above and posteriorly to the gall bladder. The size, tone and function of the gall bladder the latter tested according to Bromer's method, were normal.

Calcium deposits in the lymph glands in the hilum of the hilus of the liver may be caused by tuberculous or less frequently by typhoid fever. The glands may be found in four locations: (1) along the hepatic artery, (2) along the cystic duct, (3) at the confluence of the cystic and hepatic duct, to the right of the common duct at the free margin of Winslow's foramen, and (4) in the duodenopancreatic groove to the right of the common duct. Calcifications in all these glands can be detected in roentgenograms taken in two directions.

Calcium deposits in a syphilitic gumma or in multiple liver abscesses may also simulate gall stones.

**JOSEPH K. KATZ, M.D.**

**Allergic Cholecystopathy and Secondary Cholecystitis following Dysentery (Allergische Cholekytopathie und sekundäre Inferecholekytitis nach Dysenterie) WALTER STOCKER, *Dtsch. med. Wochschr.* 1948, 73, 223**

The author calls attention to the fact that there has been very little in the literature to suggest any connection between bacillary dysentery and gall

bladder disease in contrast to the typhoid paratyphoid infections. In a series of 426 cases of cholecystitis he has found a history which was positive for such a dysentery in 125 patients, or 29.3 per cent. He admits that the war conditions during the period of these observations may well have altered the number of dysenteries as these were quite frequent during this time.

In the early part of the series the main complaint of the patients was not suggestive of gall bladder disease but consisted of epigastric pain and some tenderness in the upper right quadrant of the abdomen. Some 2 to 4 months after the dysentery had disappeared no reoccurring symptoms attributable to disease of the gall bladder in the form of localization, ulceration and in some instances fever directed the examination to the biliary tract.

The author considers the possible etiologic connection. He believes it to be an indirect one rather than direct bacterial invasion of the gall bladder. His attention to the allergic manifestations which have been observed in bacillary dysentery and the sequelae of the mucous membrane of the gall bladder which shows the effect of an allergic reaction. He believes that a gall bladder which has had a previous allergic response is then more liable to infection by opportunistic bacteria which will not affect a normal and normally functioning organ. Once such an infection has occurred, the process is the same as in the ordinary case of gall bladder disease of bacterial nature.

**WILLIAM C. BEECH, M.D.**

**A Contribution to the Anatomohistologic Study of Benign Tumors of the Gall Bladder (Contributo anatomo-tumorologica Do studio dei tumori benigni della cistifellea) ANTONIO BLANCHI, *Gazz. Med. Ital.* 1948, 4, 33**

Benign tumors in the fundus of the gall bladder of 8 patients whose autopsies are reported. These findings were encountered in 3,000 autopsies which were done at the Pathologic Institute "Guglielmo Roncati" in connection with the University of Naples.

The benign tumors reported in the literature for this location are fibromyomas, fibroadenomas, adenoma, papillary fibroepitheliomas or benign papilloma, fibroma, myxoma and lipomas. The last mentioned have never been reported in the human being and are known from veterinary reports on a animal pathology.

The author's material includes only adenocystomas (3 cases) and adenofibroblastomomas (3 cases). The latter 3 were so designated because of the presence of evidence of young connective tissue proliferation. The remaining 3 cases were examples of simple benign papilloma. The papillomas are discussed separately because of the author's belief that their pathogenesis is different. None of these tumors occurred in children. In no case was there evidence of inflammatory changes in the remainder of the gall bladder and in no case were gall stones present.

## SURGERY OF THE ABDOMEN

The papillary growths are regarded as benign tumors perhaps on the basis of some constitutional factor (such as that causing warts on the skin) which are stimulated to proliferative growth by some chronic irritative process such as gall stones which was not evident at death or which had disappeared. The adenomyomas however, are regarded as true hamartomas in the sense of Albrecht, arising from fetal inclusions as postulated for tumors of this nature by Aschoff and Bacmeister.

JOHN W. BRENNAN, M.D.

### MISCELLANEOUS

**Endoabdominal Microtorsions** (Sulle microtorsioni endoaddominali) BRUNO SPATOLISANO *Ann. Ital. Chir.*, 1947 24: 574.

Mondor has been associated with the term micro-torsions the torsions of endoabdominal tissues which in spite of small volume and little functional value are usually accompanied by an imposing symptomatic picture. The tissues usually involved are the appendiceal epiplocae less often the fatty fringe of the mesentery of the appendix, and exceptionally the hydatid of Morgagni of the ovary.

A case report is presented of a 44 year old woman who was operated upon for recurrent appendicitis during a quiescent period. At operation the appendix showed signs of chronic inflammation extending

into the mesentery. At the junction of the distal and middle thirds, a small spherical tumefaction was encountered which presented a dark violaceous color with infarction and beginning necrosis and a movable peduncle about 1 3/4 cm. in length twisted twice from left to right. An appendectomy was performed. The postoperative course in this case was uneventful.

This was considered to be a torsion of a fatty fringe of the mesentery of the appendix. A review of the literature is presented. The etiology is doubtful. Some maintain that infection modifies the consistency of the epiploca in an uneven manner which predisposes to torsion others maintain that infection follows the torsion.

There have been 68 cases reported and of these, 6 involved the mesentery of the appendix. The symptoms vary to such an extent that no definite clinical picture can be given. They may simulate acute subacute or chronic symptoms. The diagnosis before operation has always been in error except for the case reported by Fiske in which Dr. Babcock is said to have made a correct diagnosis. This diagnosis was aided by the fact that the patient had had her appendix removed and there was a palpable mass. The surgeon should keep this lesson in mind when on opening an abdomen he does not find the suspected changes in the appendix or salpinx.

LUCIAN J. FROEDT, M.D.

# GYNECOLOGY

## UTERUS

**Carcinoma of the Cervix in an Urban Population.**  
A. W. DMOCH and T. R. BERNHART. *Am. J. Obst.*  
1948, 55: 669.

The present report concerns a cross section of experience in the treatment of cervical carcinoma in Dallas, Texas, from Jan. 1, 1936 to Jan. 1, 1946. The age distribution, the amount of time lost by the patient and doctor between the onset of symptoms and the diagnosis of cancer and the frequency of inadequate or inappropriate methods of treatment and their relation to sequelae, are stressed.

The survey shows that women in the vicinity of Dallas who were treated for carcinoma of the cervix, did not seek consultation any earlier than did those living in other parts of the United States. Apparently the educational programs of the American Cancer Society are not sufficiently inclusive, or far reaching. The results presented show that in spite of cancer campaigns waged by State and national organizations and the emphasis that is placed on the subject in the medical schools, there is still room for professional improvement.

Total hysterectomy followed by irradiation as contrasted to irradiation alone did not improve the chance of a 5 and 3 year survival. Actually certain types of sequelae were more common in patients who had undergone total hysterectomy than in those who had not been operated upon. In cases in which hysterectomy is indicated a total excision, properly done, offers no greater risk to the patient than the subtotal operation, and does remove the possibility of later development of malignancy in the stump.

The results reported compare favorably with those collected by others from different parts of the world yet, when it is considered that one fifth of the women received questionable or inadequate treatment it becomes apparent that the physician was responsible for the fact that the results were no better. A wider use of the diagnostic curettage and biopsy and proper visualization of the cervix would have originally given more positive diagnoses of cancer. Also the general use of orthodox therapeutic methods undoubtedly would have improved the survival rates and reduced the number of sequelae.

JOHN R. WOLFF, M.D.

**Hysterectomy.** LOUIS E. PRANKOFF. *Am. J. Obst.*  
1948, 55: 646.

The literature of the last decade shows that an increasing number of gynecologists have adopted the total hysterectomy or panhysterectomy as a routine operation, and have reserved the supravaginal amputation of the uterus for special cases. This is a total reversal of the opinions held by gynecologists a quarter of a century ago.

Two hundred and sixty-six hysterectomies performed by the author in 1945 and 1946 are reported. In this group there were 213 abdominal hysterectomies, of which 88.7 per cent were total. Of 53 vaginal hysterectomies included in the series, 86.7 per cent were total.

Under present-day conditions the mortality following panhysterectomy in experienced hands, should not be greater than that of the less formidable procedure. The convalescence has been simplified by proper preoperative care so that the patient reaches the operating table in improved or satisfactory condition, and the postoperative care has been greatly improved.

The technique of operation has not changed remarkably during the past 15 years. One noteworthy point however has been the tendency toward closing the vagina and the abdomen without drainage. Experience has shown that the sulfonamides exert their most satisfactory effect when given orally or parenterally rather than when left in the pelvis before the abdomen was closed.

In this group of 266 patients, 3 died. A gross mortality of 1.1 per cent. Case histories giving the details of these deaths are given.

JOHN R. WOLFF, M.D.

## ADNEXAL AND PERIUTERINE CONDITIONS

**Accidental Intravascular Injections of Lipiodol during Hysterosalpingography (Injections vasculaires accidentelles d'lipiodol survenant au cours de l'hystérosalpingographie).** R. KELLER, *Gyn. Obst. Pa.* 1948, 47: 7.

The author reports a case of massive lipiodol injection into the uterine and periuterine venous plexuses which caused symptoms of pulmonary embolism, the latter being confirmed by roentgenography.

An accidental intravascular injection may occur when (1) too high a pressure is used during the performance of the hysterosalpingography (2) too large a quantity of lipiodol is used (3) vascular injury is produced by instrumentation (4) abnormal vascular fragility or permeability is present (5) there is patency of the vessels of the uterine mucosa (menstruation, metrorrhagia, chronic infection) or (6) the cavity to be injected is of small size (uterine hypoplasia, obturation of the tubes, salpingectomy).

The intravenous injection of lipiodol can produce two types of roentgenographic pictures (1) a diffuse central shadow corresponding to the injection of the capillaries of the uterus, and (2) shadows of venous trunks more or less filled with lipiodol located on the edges of the uterine wall. These correspond to the uterine utero-ovarian, and hypogastric veins. There is a characteristic shadow produced when the uterine veins are injected with lipiodol. The opaque sub-

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stance does not completely fill the lumen of the veins but produces lacunar shadows with enlargement in some areas arranged in a downward loop.

Once injected into the circulation the lipiodol is dispersed so that it can hardly be seen beyond the genital area. These droplets accumulate at terminal points. Therefore roentgenography can reveal their presence in the lung fields.

In the author's case the diagnosis of pulmonary lipiodol embolism secondary to injection into the uterine veins was established by means of roentgen rays and by analysis of the patient's bloody expectoration which revealed drops of lipiodol.

A massive injection of lipiodol may be lethal. As a rule it produces no or only minor clinical symptoms.

The author concludes his article by reviewing the measures to be carried out in order to avoid such an accident during hysterosalpingography. A manometer should be used and the pressure should not exceed 39 cm. of mercury. Vascular injection has been observed, however with pressure much lower than this. Continuous x ray control is imperative during the injection. One should be guided by the patient's reaction. The injection must be stopped if the patient complains of pain. The injection must be slow and continuous. One must absolutely avoid traumatizing the tissues. The use of a malleable cannula is to be recommended. A special period of time must be determined for the hysterosalpingography. The author recommends the twenty first day of the menstrual cycle as the optimal time.

The injection should not be done if the patient has vaginal bleeding.

The injection should be discontinued when an abnormal shadow appears during fluoroscopy.

One must be cautious when dealing with an infantile type of uterus or when one or both tubes have been removed.

GERARD GAONON M D

**Primary Double Tumor of the Ovary (Primární duobla tvářejčnických nádorů)** JAROSLAV SYNEK.  
*Lék listy 1948 3 149.*

A 22 year old unmarried seamstress was suffering from a rather persistent, subfebrile ailment of undeterminable nature. In the course of a consultation with the medical man in charge of the case the author discovered a tumor mass which filled the entire pelvis and extended a bit up into the main abdominal cavity. At laparotomy the mass proved to be a tumor, one above the other and both attached to the region of the left ovary. The upper mass was attached by the ligamentum ovarii proprium and mesovarium in the same manner as the normal ovary. The normal tube and mesosalpinx were stretched across its anterior surface. It was nowhere adherent and easily delivered from the pelvis. Under this tumor mass was a second tumor attached to the upper tumor by a thin band of connective tissue. The pedicle of attachment of this lower mass was the ligamentum suspensorium ovarii

which contained a dilated branch of the ovarian artery. This lower tumor mass was adherent rather widely to the posterior surface of the broad ligament, to the sigmoid and to the omentum. The two masses together weighed more than 2 kgm. The lower mass is believed to have developed first pushing the upper growth upward toward the general abdominal cavity.

The upper mass corresponding to the real ovary exhibited macroscopic and microscopic findings typical of a seminoma (R. Meyer) the lower corresponding to the supernumerary ovary was typical of a cavernous hemangioma. The rarity of the condition consisted in the peculiar association of the two. In the pedicle of the lower tumor was a thick, dense mass of tissue which histologically proved to consist of lengthy, oval spaces enclosed in a dense connective stroma which were filled with a wavy spirillar fibrillary tissue with fusiform nuclei. This tissue was shown by the van Gieson stain to be composed of muscle fibers. On downward penetration into the tumor mass itself by means of serial sections the same muscle fibers—in a bad state of preservation it is true—were perfectly recognizable as they were scattered here and there in the connective tissue septa.

The question naturally arose as to the origin of these muscle fibers. In this regard two theories have been advanced. One hypothesis (Doran, Krömer) maintains that they arise from muscle fibers from the uterine musculature which penetrate into the hilus of the ovary by way of the ligamentum ovarii proprium. It is by this route that the ovary gets its blood supply through the ovarian branch of the uterine artery. The other theory (Henroth, Herzog) claims that they arise from the muscular coat of the blood vessels. The latter concept has been rather convincingly demonstrated by means of serial sections, at least in the case of the ovarian fibromyomas by Basso. He demonstrated that the blood vessels of these tumors lack an adventitial layer in places and that the muscle fibers of the media tend to invade the surrounding tumor tissues. The author believes that in the present case he has proved the validity of the latter theory. In his patient the cavernous hemangioma corresponding to the secundinate ovary, had no connection with the hilum of the main ovarian structure and was supplied by a branch of the internal spermatic artery.

JOHN W. BRENNAN M D

**Sexually Functioning Ovarian Tumors (Tumori ovarici a funzionalità sessuale)** ADRIANO BOMPIANI.  
*Riv. ital. ginec., 1947 30: 364.*

A review of the world literature, comprising the principal articles appearing during the 10 year period from 1936 to 1946 relative to the virilizing and feminizing tumors of the ovary is reported. The new growths considered are the granulosa celled or theca celled tumors the so-called "yellow celled or luteinizing tumor including the so-called supranecrotic and Grawitz tumors of the ovary and

finally the arrhenoblastoma. The possibility of their origin from teratomas is discussed but dismissed as still not sufficiently established by the clinical animal experimental histological and hormonal studies so far reported. In fact the author concludes that there is sufficient grounds to justify the assumption that all these neoplasms may arise from various components of the tissues of the ovary itself.

The possibility of recurrence and even of metastasis associated with all of these growths is admitted nevertheless, the author favors the local removal of the neoplasm when it is still localized and enclosed in its capsule, especially in young women in the child bearing period. When the new growths show tendencies toward diffuse growth or exhibit adhesions, especially in older women following the menopause he advocates total removal of the pelvic organs.

JOHN W. BARR, M.D.

**Malignant Transformation of Cystic Teratomas of the Ovary** (Transformação maligna do teratoma cístico do ovário). RENE MENDES OLIVEIRA and LUIZ MULLER. *J. clin. gin. fac. med. univ. S. P.* 1947 p. 36.

Cystic teratomas are essentially benign, but it is often difficult to establish a clear line of demarcation between benign and malignant processes. There seems to be a no man's land between the benign and malignant characteristics of a tumor. The difficulty of ascertaining the true nature of the tumor is increased in the ovary which in addition to the types of histologic growth observed in all organs, presents also individual exclusive types with marked potentialities related to functional and morphologic diversity. These forms of growth may in some way deviate toward the pathologic side.

Cystic teratomas of the ovary seem to be more frequent than they were thought to be and they do not prevent pregnancy. Their malignant transformation is rather rare although the number of such reports has been increasing recently. The transformation is generally of carcinomatous type, endotheliomas and peritheliomas are rarer than epitheliomas and sarcomas are exceptional. The prognosis is very unfavorable. It is true that the transformation is generally diagnosed late when surgery is confronted by difficult situations. In many cases the formation of metastases is early. The mortality rate reaches 80 per cent, even when cases with early operation are included. Treatment must consequently be radical, and little should be expected from complementary radiotherapy. Radical treatment should also receive due consideration in cystic teratomas of the ovary of which most authors recommend conservative surgery.

At the Gynecologic Clinic of the University of São Paulo 24 women with cystic teratoma of the ovary were operated upon from 1910 to November 1945 and 8 cases of malignant transformation were encountered, an incidence of 33 per cent. The second and more recent case is reported.

A woman of 44 had persistent pain with a burning sensation in the left iliac fossa for the past 6 months. The pain became gradually worse and was irradiated to the flank, lumbar region and left lower extremity. During the fourth month she discovered the presence of a round tumor in the abdomen, which increased in size. Deep palpation revealed a tumor that entered the pelvis and was the size of a coconut, somewhat mobile, painless and with an irregular surface presenting small sessile nodules. On vaginal examination the tumor appeared to be the size of a myomatous degeneration. The diagnosis was uterine myoma. Operation disclosed a right ovarian tumor which was displaced to the left in front of the uterus, the latter was slightly increased in size and the left adnexa were normal. The tumor was easily removed and the patient was discharged in good condition. However histologic examination of the tumor showed that it was a dermoid cyst with carcinomatous transformation (adenocarcinoma).

Two months later the patient was readmitted. Her general condition was poor and examination revealed tumor the size of an adult head, extending above the umbilicus and filling the pelvis completely. Because of her condition she was given morphine therapy but she died a few days later.

The interest of this case lies in the fact that there was an adenocarcinoma which is a rare form of the carcinoma observed have generally been of the squamous-cell pattern. The dermoid formations of the cystic teratoma were largely destroyed by the malignant neoplasm so that the pathologist could not well establish the origin of this glandular carcinoma whether it was primary or secondary. The rapidly fatal evolution of this case demonstrates the severe malignancy of these neoplasms.

ROBERTO KENET, M.D.

## EXTERNAL GENITALIA

**Absence of Vagina** VIRGIL S. COCKRELLER, J. Am. M. 1947, 36, 85.

The incidence of congenital absence of the vagina is not known but the increasing number of cases of the condition that are being reported causes one to believe that the incidence is much higher than was originally considered. The author discussed the embryologic aspects and the historical development of the treatment of this anomaly and reported a group of 76 cases of congenital absence of the vagina encountered at the Mayo Clinic, described a surgical procedure which he thought adequate and disclosed the results. The patients were seen and treated during the decade ending December 31, 1936. The age of these patients ranged from 14 to 49 years. Sixty-six of the patients were single and 10 were married.

A sufficient number of operations for congenital absence of the vagina utilizing the McIndoe technique with or without a Thiersch graft have been performed in this country and abroad to permit recommendation of this procedure as probably being the best and simplest one for correction of this anomaly.

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There are other methods which will give satisfactory results. This particular method produces a vagina which will be normal in depth, diameter and mobility. The risk of the operation is practically nonexistent. In this series there was no death. The morbidity rate will vary according to the amount of pelvic cellulitis which occurs. The operation is very simple technically, and consists only in the careful opening of the vaginal space and the use of a skin-covered mold or a mold without the skin as the case may be. The principle of mechanical prevention of contraction of the new vaginal tract by means of the mold is the basis for success in every one of these operations. The majority of procedures in which portions of the testine or pedicled flaps are utilized are multiple stage operations. The author doubts that the functional effect which is obtained by the McIndoe operation can be attained by any other procedure.

Most histologic evidence indicates that the normal vagina is formed from the muellerian ducts and the urogenital sinus. If there is no evidence of the muellerian ducts or epithelial buds from them the new vaginal tract had best be constructed by means of a skin graft particularly if there has been much difficulty in dissection. In other cases a graft need not be used. In each of the 76 cases reported reconstruction of the vagina was based on the McIndoe principle. In 70 cases the procedure included use of a Thiersch skin graft. In 6 cases operation was performed without it. The decision as to whether the new vaginal tract should be constructed by the use of a graft must be made at the time of operation.

#### Primary Carcinoma of Bartholin's Gland ROBERT J. CROOKER *Am J Surg* 1948 75 597

Primary carcinoma of Bartholin's gland is reported and a case of this condition is reported in a 64 year old woman who had a past history of adenocarcinoma of the endometrium which had been treated with radium roentgen therapy and surgery. Three years following this treatment the patient returned to the author with the complaint of vulvar itching of one month's duration. Examination revealed a solid growth of the right vulvovaginal gland, one half inch in diameter with a small ulcerated area on the surface. The preoperative diagnosis was carcinoma of Bartholin's gland and a complete vulvectomy was done. Three years later there was no recurrence.

Carcinoma of Bartholin's gland was first reported by Kolb in 1864. The author reviews the literature and brings it up to date by adding 4 cases to Aquilana's table including his own case. The total number of reported cases is now 88.

Statistics reveal that carcinoma of the vulva comprises from 3 to 5 per cent of all carcinomas of the female genital tract and that carcinoma of Bartholin's gland constitutes 2 to 3 per cent of all vulvar carcinomas. Among the author's 18 175 private obstetric and gynecologic patients there were 31 cases of vulvar carcinoma and 1 case of carcinoma of Bartholin's gland.

Four diagnostic criteria for carcinoma of Bartholin's gland have been laid down by Honan: (a) typical vulvar site, (b) position deep in the labia, (c) connection with the gland duct and (d) the presence of intact glandular tissue.

Carcinoma of Bartholin's gland occurs most commonly between the ages of 40 and 60. The youngest patient whose case has been reported was 19 years of age and the oldest 91 years. 22 per cent of the reported cases occurred in women under the age of 30 and 25 per cent occurred in women who were over 60 years of age. Therefore carcinoma must be considered in any patient with enlargement of Bartholin's gland.

The most frequent signs and symptoms are a cystic, painful tumor mass, an abscess or a draining sinus and swelling with soreness or itching. The size of the mass varies from that of a pea to that of an orange. Rabson and Meekers reported an average patient delay of 15 months before a physician was consulted. Treatment varies from simple excision to vulvectomy, with or without gland resection and radiation therapy (either roentgen or radium therapy) or combinations of these treatments.

Of 47 patients with careful follow up studies 5 survived for a period of 3 years.

The author has drawn no conclusion as to prognosis because of the small number of patients involved. J. ROBERT WILLSON M.D.

#### MISCELLANEOUS

##### Vaginal and Rectal Pruritus—Etiology and Treatment EDWARD L. CORNELL *Am J Obst.*, 1948 55 691

It is the author's considered opinion that vaginal and rectal itching is one of the most neglected fields in medicine. Too many physicians pass over the complaint with ease and give some palliative prescription or order the patient to take roentgen treatments or a douche. This attitude is deplorable. There is always a definite reason for the itching or burning but it takes study on the part of the physician to discover the etiology. There is no definite rule to follow in all cases. There is no patient more grateful than the woman who is permanently relieved of this distressing symptom. The present article is based solely on knowledge obtained in the author's private practice.

*Trichomonas vaginalis* has been by far the most frequent type of pruritus seen. The author suggests that the physician should become familiar with one line of attack and follow it as a routine changing management only as failure to cure appears in the individual patient. His procedure is as follows: The patient is instructed to insert one Devegan tablet nightly on retiring and to report for office treatment the first, third, and fifth day of the period for four periods. At this time the vagina is cleansed of blood and three Devegan tablets are inserted high in the vaginal vault. No douches are used. Her sexual partner must be examined by a urologist. It is



difficult to discover trichomonas in the male and often several examinations are necessary.

Thrush is the next common cause of vaginal itching or burning. Fortunately the treatment is short, effective and usually lasting. Two drams of sodium borate are dissolved in about one ounce of glycerine, and a tampon soaked with the solution is placed high in the vaginal vault. The treatments are given daily for 4 days. During pregnancy thrush does not respond readily to treatment.

Many women wipe themselves forward toward the vagina after a bowel movement with the result that the vagina and urinary tract may become infected with the colon bacillus. Contaminated water used for douching may also be a source. The diagnosis is made by smear and culture. The treatment has been simplified since the introduction of sulfonamides. Other types of bacterial infection seen as a cause of vaginal burning or itching are the taphylococcus, streptococcus, and the gonococcus. The infection responds to the sulfonamides, except that the gonococcus responds best to penicillin. In some cases of taphylococcus infection both sulfathiazole and penicillin have to be used.

Vaginitis is occasionally seen following the use of cauterizing drugs, such as strong solutions of silver nitrate, zinc-sulfate, neogatan, etc. When these drugs are discontinued the vagina clears up promptly as a rule. Some patients are allergic to dyes such as gentian violet, brilliant green, etc. The injection of a mild lubricating jelly helps to relieve the pain and prevents the mucous membranes from adhering.

In women past the menopause senile vaginitis often produces itching, burning or both. The use of estrogen by mouth usually clears the vagina in less than a month. The physician must rule out external causes such as leucoderma and leucoplakia as well as trichophyton infection and lack of cleanliness. Pediculosis, scabies, and diabetes must be ruled out.

Rectal itching is a very distressing symptom and the diagnosis of the cause is often baffling. Ameba, or some other type of intestinal organism may cause irritation with or without diarrhea. Worms of various types are said to be the etiologic factor. The treatment of these patients is directed toward clearing up the bowel by appropriate medication to remove the ameba, worms, etc. together with local treatment with gentian violet. The second common source is a fungus growth. The diagnosis is readily made clinically by painting the area with a 3 per cent to 5 per cent aqueous solution of gentian violet. In a few hours the itching ceases or is markedly relieved. The dye has to be carried into the anus a short distance because the fungus infection often extends to the mucous membrane.

JOHN R. WOLFF, M.D.

**Employment of the Prone Position in the Treatment of Vesicovaginal Fistula (Sul trattamento bocconale delle fistole vesico-vaginali)** MACACOS G. B. *Arch Ital Med* 1947 14.

The author recognizes the successful operative results obtained in cases of vesicovaginal fistula and

cites the necessity for employment of the prone position in treating these patients. He describes 2 interesting cases of this condition.

The first was that of a 35 year old woman who developed a vesicovaginal fistula after her last delivery. Eight months after the onset she was operated upon under spinal anesthesia, according to Sims' method. Immediately following surgery she was placed in the prone position with a Pezzar catheter in the bladder which was irrigated with small amounts of sterile water. A few years later the patient developed uterine prolapse, for which an anterior colporrhaphy was performed. During this operation no traces of the former vesicovaginal fistula could be detected.

The second patient, age 38, having the same condition, was treated in a similar manner. Within 25 days the wound closed.

The author stresses the prone position to avoid contact of the urine with the wound. Insertion of the Pezzar catheter is insufficient for deviation of the urine from the wound. Certain surgeons go so far as to rely on the lateral or ventral position completely without inserting a catheter; however the author advocates the use of one. ARTHUR F. CIPOLLA, M.D.

**Endometriosis Outside the Uterus (Endometriosia al di fuori del fero)** CLOVIS CORRADI DA COSTA. *J. Brasil. G.* 1948 25 7.

Eighteen years before she was seen by the author a woman of 43 years began to show some hard and painful nodules on the internal aspect of the thighs. During the week before menstruation the nodules became red and more painful and finally exuded blood. This coincided with or followed menstruation. The bleeding usually lasted 3 days and gave great relief to the patient who had a true dysmenorrhea. The bleeding recurred through the same site for 3 or more menstrual cycles until the nodule was replaced by a stellate scar. Then a new nodule formed back passed through the same phases. About 6 or 7 years before the author saw this patient similar nodules developed in the submammary folds on both sides, on the pectoral areas, and in the vicinity of the axillae. The woman had been operated upon 5 times and considerable amounts of bleeding tissue had been removed from the thighs.

At examination the author found on the internal aspect of the thighs a 1 d in vicinity of the breasts, old healed lesions with stellate scar and recent lesions consisting of small, hard, and infiltrated nodules of reddish color which raised the skin, were painful, and presented central perforations from which blood exuded spontaneously or under compression. The thighs showed 31 scars. Three or four foci were active in the thighs and more in the mammary region. There was a small myomatous nodule on the posterior surface of the uterus. A biopsy specimen from the thigh showed the typical picture of endometriosis.

The author had the chance to observe 2 other cases of endometriosis outside of the uterus but was not in

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a position to obtain histologic confirmation of these conditions. One patient had a small nodule on the external aspect of the right thigh which increased in size became reddish and painful and bled at the time of menstruation. The other patient had a similar nodule in the palm of the left hand which became painful large and red and exuded blood during menstruation.

It is difficult to reconcile the metastatic theory of Halban and Sampson with the facts observed in the reported cases. Why would metastases have developed exclusively in the thighs so many years ago and have remained localized there for 6 years subsequent to invade the mammary region only? There is certainly no anatomic reason to justify the persistence of metastases solely at two points. The only possible explanation is the development of blastomeres and the subsequent formation of endometrium alone after all other potentialities have been lost.

RICHARD KRAVETZ, M.D.

**The Treatment of Pelvic Endometriosis.** HENRIK E. SCHMITZ and JAMES E. TOWN. *Am. J. Obst.*, 1948 55 583.

The treatment of pelvic endometriosis is either radical or conservative. The complete destruction or removal of all ovarian tissue results in regression of the ectopic endometriomas but inasmuch as most women suffering with this condition are in the child bearing period, this is a costly price to pay. Pelvic endometriosis is a major cause of sterility. Conservative treatment which will increase the possibility of conception is therefore the most desirable form of therapy. However individualization is necessary in each instance as the age of the patient her desire for offspring and the extent and location of the disease influence the decision as to the ideal treatment for that particular patient.

A review of 130 patients who were treated with this intent shows that 57 were treated surgically and of these 10 patients required radical surgery. Surgery is by far the most satisfactory form of treatment because it permits a careful inspection of the peritoneal cavity and microscopic confirmation of the diagnosis. Of those treated with conservative surgery 25 obtained complete relief and 9 of these subsequently became pregnant.

Röntgen therapy was employed in the treatment of 29 patients, 17 of whom were given sufficient dosage to cause a permanent menolipis the others were treated with a smaller dosage causing a menolipis of from 3 to 8 months. In this group 2 patients conceived and were delivered of 3 infants. Röntgen therapy in this group proved satisfactory as secondary therapy when conservative surgery had failed. Röntgen therapy of sufficient intensity to destroy ovarian function is indicated in cases in which endometrial tissue has invaded the bowel or bladder. It obviates the necessity of surgical resection with its increased risk.

Hormone therapy with androgens in young patients with minimal complaints not only corroborates the diagnosis when it subdues the symptoms, but it may enable the physician to carry his patient to an age when more radical treatment would not be so costly. It has been the authors' observation that some patients have pelvic endometriosis without discomfort and that other patients recover spontaneously.

Androgen therapy was used in 15 of the cases in the authors' series. These patients were young with minimal pathology, small nodes or single small cysts but with definite relationship to the menstrual cycle. One patient conceived during this treatment and delivered a normal infant.

JOHN R. WOLFF, M.D.

# OBSTETRICS

## PREGNANCY AND ITS COMPLICATIONS

Observations on 14 Cases of Late Extrauterine Pregnancy  
H. HUDNALL WARE, JR. *Am J Obst*  
94:5, 55-56

Thirteen cases of extrauterine pregnancy of 28 weeks duration (or longer) are presented, and 249 cases which have appeared in the literature since 1933 are reviewed. Twelve patients were operated upon. The maternal mortality including a mother who left the hospital and died 3 months after operation was 25 per cent. The maternal mortality for all 13 cases including one woman who died undelivered, was 30.76 per cent.

A history of lower abdominal pain, from the onset of pregnancy or soon thereafter accompanied by indigestion, constipation and sometimes irregular vaginal bleeding suggests an extrauterine pregnancy. The absence of uterine contractions when the fetus is palpated, a transverse or abnormal position of the fetus, a firm long cervix, and a small empty uterus confirm the diagnosis. Roentgen examination of the abdomen and hysterosalpingograms were valuable aids in confirming the diagnosis.

An extrauterine fetus can remain viable and continue to grow after repeated episodes of uterine bleeding. Regular rhythmical uterine contractions were observed in a patient with an extrauterine pregnancy.

The treatment in each case must be individualized. The placenta should be left *in situ* and the abdomen closed without drainage whenever removal of the placenta may cause hemorrhage or damage to a vital organ. Removal of the placenta should be reserved for those cases in which the placental blood supply can be easily tied off and the placenta is not attached to a vital organ.

The placenta can be absorbed from its attachment in the peritoneal cavity without causing elevation of temperature or adhesions in the pelvic cavity.

When the placenta is left *in situ*, positive Friedman tests have been obtained on urine from the patient 35 days after operation.

The use of penicillin and sulfonamides may prevent or decrease infection in the placenta when it is attached to the intestine and left *in situ* and the abdomen is closed without drainage. Transfusions of whole blood and the use of new coagulants may be lifesaving measures in combating hemorrhage at the time of operation.

JOHN R. WOLFE, M.D.

Plasma Proteins in Pregnancy J. L. MACARTHUR,  
*Am J Obst* 94:5 55-58.

The author undertook to determine if a simple method of estimating plasma proteins could be adapted to routine use in office obstetrics and be sufficiently accurate to be clinically useful. Its application to a group of patients is described and dis-

cussed. A short reference to the physiological and clinical aspects of the plasma proteins is given.

Compared with plasma protein determinations by Kjeldahl analysis the gravity method described, with an aqueous solution of copper sulfate, has proved to be accurate to within 0.3 gm. per 100 cc. The stability of the solutions and the simplicity and simplicity of the test make it ideal as an office procedure.

The hypoproteinemia of normal pregnancy is related to the plasma dilution. Combined hematocrit and plasma protein estimations give more information than the plasma proteins alone. The hypoproteinemia coincides with the increased plasma volume and in order to estimate the true level of plasma proteins the percentage of dilution should be added to show the plasma proteins well within the normal range.

After correction for plasma dilution, such normal levels have not been present in the patients with toxemia. In pre-eclampsia a difference of 30 per cent was found while in eclampsia the difference became more marked as the hematocrit levels rose, and the plasma proteins fell. The relationship between hematocrit and protein levels may prove to be a valuable diagnostic aid in toxemias; an increase in difference between them is a poor prognostic sign while a decrease in difference suggests improvement.

During the course of this study an attempt was made to evaluate the effects of supplementary feedings with protein hydrolysates by mouth and vein in normal patients and in those with toxemia. Over short periods of time no elevation of plasma proteins or improvement in the clinical condition of patient with toxemia of pregnancy was noted.

The hypoproteinemia of pre-eclampsia and eclampsia is very likely due to failure of albumin synthesis by a damaged liver. The essential amino acid methionine may by its protective action upon the liver materially aid in the prevention and treatment of toxemias of pregnancy. A case is presented to show dramatic changes in weight, edema, and clinical improvement of the patient after 5 days on the usual pre-eclamptic routine had failed.

JOHN R. WOLFE, M.D.

The Puncture of the Amniotic Sac and the Amniocentesis (La ponction de l'amnios et l'amniocentèse).  
L. PORTES and A. GRANTON. *Gyn Obst Pa* 94:47-48.

Puncture of the amniotic sac through the abdominal wall has not received sufficient attention from the French obstetricians. This procedure must be harmless for the mother and the fetus. It can be done without undue trauma and without anesthesia if a lumbar puncture needle and the Claude macometer are used.



Fig. 1 (Portes, Granjon) Fetus dead in utero. Amniography with tenebryl. (Figure upside down on purpose.)



Fig. 2 Fetus dead in utero. The needle has been intentionally inserted into the fetus. The spinal canal has been injected. Labor has not yet been induced. A second injection



tion 48 hours later easily induced labor.  
Fig. 3. Same patient as in Figure 1. (Film taken one hour later.) The fluid injected into the amniotic sac is eliminated through the kidneys of the mother. The bladder is completely opaque.

The authors advocate aspiration of the amniotic fluid in cases of acute hydramnios which allows continuation of the pregnancy until the fetus is viable or the injection of normal saline solution to induce labor in cases with retention of a dead fetus in utero. Finally by the injection of opaque substances into the amniotic cavity the spontaneous and induced contractibility of the uterine wall may be studied under the fluoroscope. The placenta may be identified certain fetal malformities may be demonstrated and the passage of certain pharmacodynamic or hormonal substances through the placenta may be determined.

The authors have been able to demonstrate that only the distention of the amniotic sac can induce labor. The injection of the uterine muscle even injection into the dead fetus cannot incite contractions.

To induce labor in cases of retention of a dead fetus in utero the authors injected from 300 to 600 c.c. of normal saline solution the amount depending upon the age of the pregnancy.

GERARD GAGNON M.D.

**The Test of Labor with Breech Presentation in the Contracted Pelvis** (L'épreuve du travail sur le col au cours des accouchements en présentation du siège dans les bassins rétrécis). RIVIERE, CHASTRUSSE, and MISON. *Rev. fr. gyn. obst.* 1947 42 303.

The poor prognosis in the delivery of a fetus in breech presentation through a contracted pelvis has long interested the authors. Under similar conditions with a vertex presentation a test of labor is justifiable in the majority of cases. Classically these

patients are brought to complete cervical dilatation and the possibility of delivery by the natural route is tested by the fetal head. With a breech presentation however this is considered unworkable illogical and dangerous. After a variable length of time following the engagement and descent of the breech the head (the principal obstacle) traverses the genital tract only when there is no other solution than to complete the extraction at any cost. Therefore cesarean section is carried out at the onset of labor.

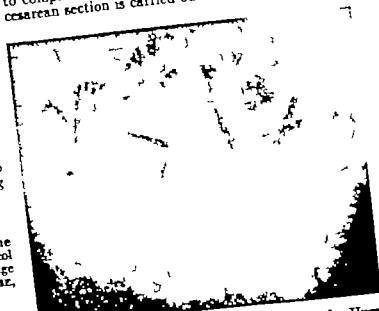


Fig. 4. (Portes, Granjon) Pregnancy of 7 months. Huge hydramnios. Amniography with tenebryl. Lateral view. Anencephalus.

The daily practice of allowing a test of labor in vertex presentations with contracted pelvis, results in vaginal delivery in 80 per cent of the patients. The indication for intervention comes in the majority of cases, not from an incompatibility of the cephalic and pelvic diameters as judged when dilatation is complete but from an anomaly of dilatation which failing to progress requires interruption of the test of labor and a hysterotomy.

By contrast, every obstetrician has had involuntary cases of spontaneous delivery of a fetus in pelvic presentation associated with a contracted pelvis in which the course of labor was so rapid that expulsion by the natural route had to be accepted.

An abnormal or irregular contraction is without effect on the dilatation and incapable of causing the fetus to progress even though there is only slight resistance to be overcome. The presence of an incompletely dilated cervix always renders extraction exhausting, dangerous for the mother and murderous for the child, even if the pelvis is but slightly contracted.

In contrast a rapid, brisk dilatation allows the doctor to hope that the powerful rhythmic contractions will help him at the moment of expulsion, and justify his expectation of delivery by the vaginal route.

The authors divided their experience into three periods. From 1936 to 1942 breech presentation complicating a contracted pelvis occurred 23 times and in 15 cases cesarean section was performed. Eight vaginal deliveries occurred because they could not be avoided. One malformed infant died following cesarean section and one normal baby died following extraction.

In 1943 and 1944 there were 16 such cases. Nine fetuses were delivered spontaneously, 3 were extracted and in 4 cases low cesarean section was performed. Three of the cesarean sections were performed for anomalies of dilatation.

During 1945 there were 6 patients whose labor was actively directed instead of passively assisted. This usually consisted of 3 units of "hypophyseal" and "spasalgine" although the routine was individualized. In one case it was necessary to resort to cesarean section.

On the basis of these experiences, the authors conclude that if severely contracted pelvis and very large babies are excluded the prognosis in breech presentation associated with a contracted pelvis depends on the type of labor. The "dynamic factors of labor" are the determining elements. The rhythm and intensity of the contractions, and the continuous progression of dilatation more so than its rapidity, lead to the successful outcome of a test of labor.

On the other hand cessation of dilatation should call for immediate cesarean section.

The authors conclude that the operative indications should be the same for breech presentation as for vertex presentation in the presence of a contracted pelvis. Regular progressive dilatation allows us to expect spontaneous delivery by the vaginal

route. On the contrary anomalies of dilatation usually require cesarean section.

CRAG W. MCKEE, MD

**Pregnancy after Bilateral Salpingectomy: Concomitant Transitory Diabetes (Graviditas dopo salpingectomia bilaterale. Diabete transitorio concomitante).** UGO SANTOMAURO. *Gior med Palermo*, 1947, 41: 346.

The author reports the case of a young woman who had pain in the lower quadrants of her abdomen and in the lumbar region caused by an inflammatory process of the left adnexa. At operation most of the left ovary was removed, only a small portion corresponding to the hilus being left and the upper part of the right ovary which was studded with small cysts was excised. Bilateral salpingectomy was performed, a small subserosal fibroma of the posterior lateral left side of the uterine body was excised, and pelvic hysterectomy was done by fixation of a peritoneal flap from the vesicoouterine fold to the posterior superior wall of the uterus. The patient had regular menstruations for one year and then, after a menstrual delay of about 20 days, spontaneous abortion occurred with delivery of an embryo 15 mm. in length. After another year she became pregnant again and had a spontaneous abortion in the third month. She took contraceptive measures for 4 years, then stopped them and became pregnant. During this pregnancy she developed diabetes for which she was treated adequately and the pregnancy continued to term when she gave spontaneous birth to a living child. After delivery the diabetes disappeared. She had 3 more pregnancies. In the first pregnancy the fetus died in the fifth month, the second ended in the eighth month with premature birth of a living child. During both pregnancies diabetes reappeared, and disappeared as previously.

How was it possible for the spermatozoon and the ovum to meet in view of the absence of the tubes, of which only small stumps were left and were covered by the vesicoouterine flap when the hysterectomy was performed? To explain this it is necessary to accept that one or both tubal stumps had not been attached by the inflammatory process and that one or both cut ligatures had slipped, leaving the stumps free, or had been resorbed before compression necrosis of the tubal epithelium had occurred. The tubal epithelium must have proliferated and advanced from the resected face of the stump or through a new breach formed at the point of decubitus on the wall of the stump and made its way below the peritoneal flap which covered the stump until it reached the abdominal cavity thus making a true fistulous tract.

The author explains the diabetes as follows. As there was no sign of latent diabetes when the woman was not pregnant, she must have been in endocrine gland and sympathetic equilibrium. When pregnancy occurred, the influence of the hormones coming from the ovum caused a break in the functional equilibrium of the neuroendocrine apparatus manifested by the form of diabetes due to that type of

pancreatic insufficiency which according to Pende may perhaps depend on endocrine influences of non pathologic nature in which it is not possible to demonstrate particular pancreatic lesions histologic ally

RICHARD KEMEL, M.D

**Cancer and Pregnancy; Sarcoma of the Abdominal Wall with Various Recurrences Associated with Pregnancies (Cancer e gravidez. Sarcoma da parede abdominal com várias recidivas ligadas a gestações)**  
MÁRIO KROOK *Rev. brasil. cancerol.*, 1947 1 31

At the National Cancer Service in Brazil, clinical experience has created the impression that intercurrent pregnancy in a case of cancer aggravates the evolution of the tumor. For instance there was a case of apparently cured or arrested carcinoma of the maxillary sinus which developed rapidly after the first month of pregnancy similarly, a case of ulcerated sarcoma of the forearm healed by roentgen therapy became aggravated in a few days when the patient became pregnant. The following case is even more conclusive

The patient at the age of 25 developed a sarcoma of the anterior abdominal wall in February 1937 when she was 6 months pregnant. She stated that in infancy she had had an abscess at the same site which left a yellow reddish nodule as residue, that she was a weaver and that the nodule had been traumatized repeatedly by a spring of the loom at which she worked. The tumor was excised 2 months after delivery. However in June, 1938 when she was 2 months pregnant she noticed at one of the extremities of the surgical scar a nodule which grew from the size of an almond to that of a large orange in 2 months. When referred to the Cancer Center she presented in the umbilical region a round tumor the size of a fetal head and ulcerated over the greatest part of its surface. The tumor was diagnosed as a fibromyxosarcoma and removed. The pregnancy continued to term. The tumor recurred and was again excised in 1939, 1940, 1943 and 1946 each time during a pregnancy. Thus in 6 years from February 1937 to March, 1943 this patient had 5 bouts of sarcoma in association with 5 pregnancies. Then she decided to use contraceptive measures and there for 3 years she did not become pregnant and there was no recurrence of the sarcoma. But when she neglected the contraceptive precautions and again became pregnant she developed the sixth attack of sarcoma in January 1946. The relationship between cancer and pregnancy became so evident to the patient that cicatricial pruritus constituted for her the best index to her genital condition. The 6 pregnancies resulted in 3 deliveries at term and 3 abortions.

Treatment of the various recurrences has kept the patient in a state of apparent cure for more than 10 years. The tumors of varying sizes were removed without ventration by the method of electrothermal coagulation sometimes during the pregnancy. Roentgen therapy was used once and resulted in radionecrosis without disappearance of the lesion.

This treatment was applied to the abdominal wall during a 4 months pregnancy in a dosage of 4 600 roentgens over 30 days. It did not cause abortion or sterilization of the patient but it must be admitted that the irradiations were given tangentially and that the uterus was below the level of the irradiated zone.

The following problems arise with the admission of the noxious effect of pregnancy on the evolution of cancer. Should patients with cancer of the breast, or those who have been operated upon for cancer nurse their children? Does nursing help to transmit susceptibility to cancer from mother to child and from nurse to nursing? Should patients operated upon for cancer of the breast, even after a 5 year cure get married? Should they become pregnant? If pregnant should they be subjected to abortion? Should roentgen castration be performed routinely in all patients with breast cancer whether operated upon or not?

RICHARD KEMEL, M.D

## MISCELLANEOUS

**Medical Report for the Year 1946**  
GARREY and J. T. SWAN BROWN  
*Maternity and Women's Hospital*

MATTHEW M.  
*Glasgow Royal*

A report from the Glasgow Royal Maternity and Women's Hospital (a 168 bed hospital) for the year 1946 gives a total admission of 4 643 patients.

There were 3,347 births. Of these 3,062 were live births and 285 were stillbirths. There were 171 neonatal deaths giving a fetal mortality of 456 or 13 per cent.

The maternal mortality was 47 or 1.01 per cent. Two hundred and sixty-six cesarean sections were performed an incidence of approximately 8 per cent. Of these 147 were classical procedures with 4 deaths (2.7%) and 119 were low cervical sections with no deaths. The gross maternal mortality for the whole series was 1.5 per cent.

The whole series of 3,347 births is broken down in to abnormal presentations hemorrhage antepartum and postpartum toxemia disproportion and sepsis with a detailed description of each case in the above categories.

It is unfortunate that there does not exist a universal, standard form with a common terminology for obstetrical reports of this type. Such a form would clarify the information contained in the report and would eliminate the detailed description of individual cases.

CHESTER C. DOHERTY, M.D

**Chorioepithelioma of the Uterus with Vaginal Metastasis (Córrioepitelioma do útero com metástase vaginal)**  
RANDE MEXNER OLIVEIRA and JAMIL DAUD  
*An. dist. gis. fac. med. USP S. Paulo* 1947 p 57

The authors present 2 cases of chorioepithelioma in women of 24 and 52 years, respectively. In both the metastasis consisted of a soft dark red nodule the size of a nut, which bled easily when touched. In the first case the nodule was located in the vulvar vestibule just below the urethral meatus, in the second it was in the anterior vaginal wall on the

median line and about 4 cm. from the urethral meatus. Hysterectomy bilateral adnexectomy and excision of the nodule were performed in both patients with apparently good results.

Chorioepithelioma, which is very malignant and leads to early metastasis, is a rare tumor that generally develops in the area of ovular implantation and may occur after normal delivery, abortion, or hydatiform mole. In the first case it occurred after an abortion in the second it was preceded by a hydatiform mole. It seems that the incidence of chorioepithelioma following hydatiform mole is between 6 and 10 per cent. The average age at which the tumor occurs has been estimated at 34 years. The tumor is found more frequently in multiparas than in primiparas in the first case the patient was a primipara and in the second a multipara with 12 deliveries at term.

Macroscopically the tumor has a nodular form, is polypous or infiltrating has a hemorrhagic aspect and a dark red color and is very friable. It invades the uterine wall, destroys the walls of the vessels, and throws trophoblastic cells into the circulation, thus it initiates metastases at points remote from the primary tumor. The histologic picture is characterized by the presence of columns or alveoli of trophoblastic cells separated by spaces full of coagulated blood in which occasionally chorionic villousities in a state of regression may be found.

Retrograde metastasis to the vagina and vulva in the form of nodules of varying sizes is frequently observed in uterine chorioepithelioma, these metastases resemble hematomas or angiomias. Vaginal metastasis is frequent but less frequent than pulmonary metastasis. The latter was absent in the 2 reported cases. The finding of vaginal metastasis in these cases suggested the possible presence of chorio-

epithelioma, and biopsy of the nodules confirmed the correctness of the suspicion. It is to be noted that in the first case recurrence of the nodule at the same site was nearly immediate after extirpation which was done elsewhere.

The diagnosis may be made clinically or biologically. The clinical diagnosis is based on the symptomatic triad of uterine chorioepithelioma: recurring metrorrhagia, a fetid discharge due to necrosis of the tumor and temperature indicating infection and vascular thrombosis. The tumor is asymptomatic when it is intramural. However these symptoms are not always present in characteristic form, chiefly in incipient cases. The biologic diagnosis is based on the fact that the pregnancy test becomes negative 1 to 2 to 4 weeks after delivery or abortion and 1 month after evacuation of a hydatiform mole. Persistence of a positive test after evacuation of the mole has in itself no great significance as long as the titer decreases or remains stationary; but an increase in titer must be carefully watched. There are also cases of negative reaction in the presence of chorioepithelioma.

The prognosis is poor, from 70 to 80 per cent of the cases are fatal. However periodic determination of the amount of hormones in the blood of women who have expelled a hydatiform mole may reveal the beginning of the development of chorioepithelioma, and allow the institution of early and radical treatment. The period for which these women must be watched is at least one year. Regression and spontaneous cure of the primary tumor and its metastases are possible. The course of both reported cases was satisfactory 10 and 4 months, respectively after the operation. The authors believe that early operation offers the best chance for cure.

ROBERT KIRK, M.D.

# GENITOURINARY SURGERY

## ADRENAL, KIDNEY AND URETER

**Two Cases of Arterial Hypertension Treated Surgically** (Dois casos de hipertensão arterial tratados cirúrgicamente) L. DE MORAIS ZAMITH. *Rev Port Obst gín. cir* 1948, 1: 29

Two cases of unilateral hydronephrosis accompanied by arterial hypertension are reported by the author

In a man 23 years of age the hydronephrosis showed signs of infection and was responsible for fever and painful phenomena. Roentgenographic studies showed absence of renal or ureteral calculi while ascending pyelography demonstrated an obstruction in the ureter. Decapsulation of the involved kidney and elimination of the angulation of the ureter caused by adhesions was followed by a return of the arterial pressure to the normal level

In a woman 36 years of age the hydronephrosis possibly of congenital origin, had been of a silent nature until the patient reached the age of 31 years when signs of hypertension appeared. Left hydronephrosis was discovered in roentgenograms and a nephrectomy was performed. The pathologic examination showed chronic interstitial nephritis with arteriosclerosis. Remarkable amelioration occurred but did not last more than a few weeks and the blood pressure gradually reached the preoperative level. Probably similar changes were present in the other kidney and possibly in the entire arterial system. This case demonstrated the necessity of close collaboration between the cardiologist and the urologist for the purpose of early detection and elimination of hypertension of obscure origin.

In the first case the formation of the hormone renin was probably conditioned by the disturbance of the equilibrium between the arterial pressure and the pressure of the filtrate in the glomeruli. Renin determines the formation of the peptide hypertension which plays a great role in arteriospasm. After the re-establishment of the equilibrium between the arterial pressure and the pressure of the filtrate in the glomeruli after the operation no more renin was formed

JOSEPH K. NARAT, M.D.

**Renal Complications of Hyperparathyroidism.** EDGAR BURNS and C. MARK WHITEHEAD. *J Urol* Balt., 1948, 59: 664

Although more than 350 cases of hyperparathyroidism have been recorded to date, the disease is a relatively rare one. The incidence being probably no more than 1 in each 1,500 hospital admissions. The more than 4 additional cases from the Ochsner Clinic, New Orleans, Louisiana. The parathyroid adenoma is a benign lesion but from the standpoint of endocrinology it is an active tumor causing metabolic disturbances which increase the serum calcium and lower the serum phosphorus concentrations.

Both calcium and phosphorus are excreted in abnormally large amounts in the urine.

The kidneys may be involved in three ways. In the first there is a formation of calcium phosphate stones in the pelvis with secondary pyelonephritis. In the third there is an acute parathyroid poisoning with anuria and death with calcium deposits in the renal parenchyma but without chronic renal changes. In the second there is an intermediate condition simulating both glomerular and vascular nephritis. Hyperparathyroidism should be considered in every case of renal calculi. Surgical removal of the parathyroid adenoma is the only effective treatment. Except in acute conditions of the urinary tract such as ureteral block the parathyroid tumor should be removed first. Results of roentgen therapy have been disappointing.

JOSEPH E. MAURER, M.D.

**Hemorrhage into Parenchymal Lesions of the Kidney** LEON HERMAN. *J Urol* Balt. 1948, 59: 544

Herman reports 2 cases of patients in whom massive spontaneous hemorrhage into and around parenchymal lesions of the kidney occurred.

In the first case massive spontaneous hemorrhage into and around a large renal lipoma caused severe pain and the sudden development of a large mass in the loin. In renal lipomatosis, the diseased parenchyma is replaced by hilar fat until merely a thin peripheral layer of uninvolved kidney tissue remains. Renal stones frequently are associated. The first patient had a large tender mass which filled the loin space and extended to the midabdominal line and midway between the umbilicus and inguinal canal. The overlying muscles were rigid and the umbilicus and surrounding tissues were infiltrated with dark blood. At operation the kidney tumor mass resembled a hypernephroma with spontaneous rupture due to intratumoral bleeding. The pathologist reported an intrarenal lipoma growing possibly from the peripelvic fat originally but finally impinging upon and compressing and distorting the renal parenchyma of the lower pole. The second patient had a congenital single kidney multiple cysts, and intracystic hemorrhage which caused ureteral compression with anuria. Evacuation of clots from the cyst resulted in prompt filling of the ureter and spontaneous emptying of the pelvis.

DAVID ROSENBLUM, M.D.

**Clear-Cellled Tumors of the Kidney (Tumores del riñón a células claras)** JOSÉ MARIA MAINETTI. *Rev med hosp Ital La Plata* 1947, 4: 27

Four cases of Grawitz hypernephroid tumors of the kidney are reported. The patients were 3 males and one female all adults and in all the tumor was on the left side. The usual symptoms were hematuria, renal colic, loss of weight and strength as well as the other symptoms and signs of renal tumor. At operation in one case the tumor was found to be so



adherent to the elevated and widely spread left colic flexure that a colectomy was done with the production of a temporary artificial anus. In this case, also, there were adhesions to the muscles of the back, and the pedicle of the involved kidney contained huge arterial branches nevertheless the operation was successfully completed and the patient recovered began to put on weight and gain in strength. The artificial anus was later suppressed by cutting through the dividing spur between the two colonic loops, and the opening in the abdomen at this point was closed entirely within 30 days.

The author believes that the theory of origin of these Grawitz tumors from embryonic inclusions of suprarenal cortical tissues within the kidney has been pretty well disproved. He believes that they arise from the tissues of the kidney itself. Whatever their origin, however, they are the most common tumor of the kidney in adult life and their malignancy is undisputed. When the descending pyelographic examination discloses defective or absent kidney function the author thinks that it denotes tumor-cell thrombotic obstruction of the renal veins. The veins should then be carefully examined as far as the vena cava and extirpated or the thrombi extracted, a recommendation by Beer. JOSEPH W. BARNES M.D.

**Renal Decapsulation for Anuria.** LEVINO J. SHAPIRO  
*J. Urol. Balt.* 94:8, 59: 538.

The author states that one must not temporize in the treatment of anuria which is due to the toxic action of the sulfonamides. Cystoscopy and ureteral catheterization should be carried out promptly to determine whether crystals are a causative factor and even if these are absent pelvic lavage with bicarbonate solution should be performed. If anuria is not relieved bilateral renal decapsulation should be performed without delay. A slight increase in elevated intrarenal pressure may play a part in the production of anuria.

In both cases cited by Shapiro a waterlogged condition of all the tissues was strikingly noticeable at operation. When large amounts of fluid intravenously are administered in anuria the fluid, instead of being excreted by the kidneys is deposited in all the tissues of the body and the amount retained by the renal interstitial tissue further augments the intrarenal pressure compressing the blood supply and tubules to such an extent that the process can only be reversed by the relief of this increased tension through decapsulation. Pulmonary edema and cardiac decompensation may occur if larger amount of fluid are given than can be excreted by perspiration and by the bowel and lung.

Two cases are reported in which anuria due to sulfathiazole was relieved promptly after bilateral renal decapsulation. D. VID ROSENBLUM M.D.

**Physiology of Intact Human Ureter.** JACK LAMDES  
*J. Urol. Balt.* 94:8, 59: 50.

It is postulated that tonic and rhythmic contraction of the intact human ureter are entirely inde-

pendent of the central nervous system including the autonomic nervous system and all its ganglia.

The normal adequate stimulus for the initiation and maintenance of ureteral peristalsis is a stretching of the smooth muscle fibers of the ureter by the urine excreted from the kidney.

Peristaltic activity of the ureter can be altered by changes in urine volume output, within certain limits.

Rhythmic contractions and tonus of the intact human ureter were not directly affected by the administration of tetracetyl ammonium chloride, procaine, high spinal anesthesia, doryl, epinephrine, prostigmine, atropine, traseptin, amethone, depropanex, calcium levulinate, nitroglycerine, amylinite, papaverine, perparin, lipolutin, pitressin, avertin (intravascularly), benadryl, demerol, and morphine.

Demerol, pitressin, and large doses of epinephrine produced a decrease in urine secretion.

Prostigmine acted as a diuretic in one-half of the patients to whom the drug had been administered.

No drug depressed ureteral peristalsis or decreased the tonus of the ureter. Morphine does not produce increased peristalsis and tonicity of the ureter.

JOSEPH A. LOVER M.D.

**Reconstruction of Ureter with Bladder Flap.** ROGER W. BARNES and STANLEY F. RILEY  
*J. Urol. Balt.* 94:8, 59: 466.

The authors review the literature and describe a method of reconstruction of the ureter with a bladder flap which they used on experimental animal with the following results:

The 6 calves were operated upon. One died under anesthesia. 6 died in less than 1 month. 4 lived 1 month or longer. In each case the tube made from the bladder flap remained viable. There was no sloughing of tissue of the reconstructed ureter in any case.

In the 6 calves that lived less than 1 month after surgery there were 3 in which the reconstructed ureter did not function properly. In one animal this was due to lack of a ureteral catheter as a splint, with resulting occlusion at the site of anastomosis. In the other 2 calves, urinary extravasation occurred due to a faulty technique in suturing and the difficulty of keeping ureteral catheters in place.

Of the 4 calves that lived 1 month or longer, only one had a stricture at the site of anastomosis, resulting in hydronephrosis and hydroureter. It is probable that this could have been avoided had the suture line been made diagonal rather than circular, which would have eliminated a circular scar around the ureter at one level. One other calf developed intestinal obstruction due to leakage of urine with localized peritonitis.

One calf lived 12 months after operation and was sacrificed. At autopsy no evidence was found of ureteral stricture, hydronephrosis, or hydroureter.

The difficulty of keeping ureteral catheters in place and of keeping urethral or cystostomy tubes draining in these calves added greatly to the mor-

talities. The unusual susceptibility of the calves to infection and operative trauma was also a cause of increased mortality. When this type of surgery is performed on humans, these difficulties are easily overcome by proper after care. There was no difficulty in obtaining a viable flap that would reach two-thirds of the distance to the kidney.

JOSEF A. LOER, M.D.

**The Management of the Surgically Traumatized Ureter** THOMAS D. MOORE, *J. Urol. Balt.* 1948, 59: 712

Accidental injury of the ureter during the course of pelvic operation is not uncommon. This type of serious accident has a mortality rate of 33.3 per cent for bilateral ureteral injuries and 18.8 per cent for the unilateral injuries. In difficult hysterectomies and in removal of intraligamentous tumors and cysts when the normal course of the ureter may be distorted it may be unsuspectingly injured. The incidence of such accidents may be difficult to determine because unilateral injury may be entirely unrecognized particularly if simple ligation of the ureter has occurred.

The incidence of ureteral ligation as a complication of all operations on the female genital organs may be placed at between 1 and 3 per cent. Many cases are not reported and many may not be recognized. The proportion of unilateral to bilateral injury is 6 to 1. The most common sequelae of ureteral injury are ureterovaginal and ureteroabdominal urinary fistulas.

Injury of the ureter may occur at the hands of the most skilled surgeon. Urologists believe that such injuries are preventable. They have advocated the preoperative insertion of indwelling ureteral catheters when difficult pelvic surgery is anticipated. These indwelling catheters can serve as a guide so that the ureter can be more easily recognized and avoided. However, many gynecologists are loathe to accept this precautionary measure. They contend that the catheters give a false sense of security and alter the normal position of the ureters making the ureter more liable to injury. In many instances the catheters cannot be located by palpation and can give rise to infection, ureteral colic, and oliguria. There is an abundance of evidence indicating that in spite of these objections the preliminary insertion of ureteral catheters is a wise precautionary measure. Accidental injury to the ureter can be divided into two types: (1) that in which the injury is recognized immediately and (2) that which is discovered in the postoperative period. Both types can be subdivided into unilateral and bilateral ureteral injuries. The types of injury are ligation, occlusion by acute angulation from sutures placed near the ureter, crushing or clamping, incision without severance, severance and resection of a portion of the ureter.

The simple ligation of one ureter seldom is recognized at the time of operation. If the accident is discovered during the operation, immediate deligation followed by the insertion of a ureteral catheter would

be adequate treatment. Crushing by a clamp requires essentially the same treatment as a severed ureter because of the probability of subsequent sloughing or dense cicatricial contracture. There are several procedures that may be adopted to repair this type of accident. End-to-end anastomosis has proved more satisfactory than end-to-end anastomosis of the injured ureter. A small opening above the anastomosis through which the ureteral catheter is passed to the renal pelvis and brought out of the flank for temporary diversion of the urinary stream has been advocated following the repair of this type of injury. The author warns that although the immediate results of this type of repair may be good, the patient may require frequent and systematic dilations of the ureter otherwise, slow hydro-nephrotic atrophy may necessitate late nephrectomy. If the ureter is injured low in the pelvis an attempt can be made to anastomose the ureter to the bladder.

Cutaneous ureterostomy is mentioned only for condemnation although this procedure may be regarded at the time as a conservative procedure. Although ureterointestinal anastomosis may seem a good procedure, few patients are prepared for this type of surgery as the risk would be greater than in a planned operation of this type. Ligation may be the operation of choice, especially after a difficult and long operation and if the patient's condition is considered to be poor. Before ligation of the proximal stump of the ureter it is wise to palpate the opposite kidney to determine its condition. If the extreme condition of the patient prohibits conservative measures, temporary measures less radical than ligation of the ureter, nephrectomy or cutaneous ureterostomy would permit a conservative operation at a later date: (1) the passage of a ureteral catheter through the proximal segment of the severed ureter; (2) temporary ureterostomy; and (3) temporary nephrostomy may permit conservative surgery at a later date.

In many cases the appearance of the urinary drainage from the vagina or the abdominal incision in the early postoperative convalescence of the patient is the first evidence of ureteral injury, either unilateral or bilateral. If both ureters have been ligated or otherwise occluded, the case may be erroneously diagnosed as suppression of urine. Failure to demonstrate urine in the bladder from 6 to 12 hours following a difficult pelvic operation renders a cystoscopic examination to determine the patency of the ureters as mandatory for too often the patient will be treated for suppression of urine for days before the true nature of the condition is suspected. If cystoscopic examination confirms the suspicion of bilateral ureteral occlusion, an immediate unilateral nephrostomy may prove a lifesaving measure. Temporary ureterostomy may be preferred to bilateral nephrostomy because it is technically easier to do. Deligation of the ureter is extremely hazardous and difficult. If it is attempted by the surgeon, the aid of the urologist should be elicited to literally prod the

obstructed points with a large caliber catheter (9 or 11 F) from below. This procedure would permit the surgeon to clip the ligatures quickly and recognize more than one ligated point if present. The ureteral catheters should then be passed into the renal pelvis.

The author presents 4 illustrative cases with pyelographic demonstrations showing the varied methods adapted to the management of the cases present.

In conclusion, the principal management of surgical injury to the ureter is determined by the early or late discovery of the injury and the nature and site of the accident. In instances of complete anuria following extensive pelvic surgery the possibility of bilateral occlusion of the ureters should be considered and cystoscopic examination should be done to determine the patency of the ureters. Deligation of the ureters is a hazardous and difficult procedure. The urologist may be able to demonstrate the point of ureteral ligation when the abdomen is reopened and make the procedure far safer. When the ureter has been severed or damaged, sacrifice of the involved kidney by ligation or nephrectomy is to be condemned except under the most urgent circumstances.

COSMAD A. KUTNER, M.D.

**Proliferative Tumors of Ureter.** DUDLEY P. FAGER  
STROM. *J. Urol. Balt.*, 1948, 59: 333.

Interest in proliferative lesions of the urinary epithelium has increased tremendously over recent years. Such growths have been shown to be of much more frequent occurrence than was formerly suspected.

The primary interest in this study concerns the debatable role played by epithelial nests in the etiology of solid and cystic proliferations of the ureter and renal pelvis, with only casual reference to similar growths of the bladder mucosa.

The conflicting views as found in the literature relating to epithelial crypts, buds, and nests are briefly presented.

A microscopic investigation of 120 ureters removed at autopsy has been carried out in order to study these epithelial aberrancies in their incipient stage, and to determine their etiologic significance in solid and cystic tumors of the ureteral mucosa.

Six clinical cases presenting various types of mucosal neoplasms are discussed; the microscopic findings and the surgical specimens have been correlated with the epithelial changes found in the series in which autopsies were performed.

The author concludes that hyperplasia of the urinary epithelium may result from local irritation such as chronic infection, or from noxious agents circulating in the body fluids.

Epithelial buds and crypts are but bizarre expressions of epithelial hyperplasia. The theory of "cell nest" formation as proposed by von Brunn and accepted by most present day writers is not supported by this study.

Cystic tumors of the ureteral epithelium derive from occluded mucosal crypts, whose lining cells exercise a latent secretory potentiality.

No evidence was developed that solid epithelial buds are directly associated with the origin of solid tumors of the urinary epithelium.

Twenty-one figures illustrate the important facts supporting the author's conception of the origin of these tumors.

JOHN E. KIRKPATRICK, M.D.

## BLADDER, URETHRA, AND PENIS

**The Usefulness of Immediate Post Traumatic Urethrocytograms for Diagnosis of Rupture of the Bladder** (*Utilité des uréthrocystographies immédiates post traumatiques pour le diagnostic des ruptures de la vessie*) L. SABADINI. *Presse méd.* 948, No. 9: 23

The author observed a number of traumas to the kidney urethra, and the bladder over a period of 3 years. It was his practice to examine roentgenologically every case of contusion of these organs. He observed 15 contusions of the kidney in less than a month. Immediate pyelography permitted him to recognize the intrarenal and extrarenal lesions.

In a series of 50 traumatic ruptures of the urethra, urethrograms gave him very useful information.

Sabadini advocates the use of urethrocytograms in traumatic rupture of the bladder. His method is to obtain an x ray immediately following the accident to determine if the pelvis has been fractured. He then obtains a urethrocytogram with the patient in a slight Trendelenburg position. He uses Ipiodol—40 parts to 100—diluted with two-thirds oil of pomegranate—10 parts to 100. Following the injection of the solution the pictures are taken with the patient on his back slightly turned.

Three possibilities present themselves. The fracture of the pelvis may occur without any lesion of the inferior urinary tract. The urethra is normal throughout its length. The bladder appears regular in outline. In the course of the trauma to the pelvis, the bladder although not injured, is elevated and takes the shape of an oval balloon. This modification of the vesical shape is explained by pelvic hemorrhage accompanying the fracture of the pelvis, which causes the elevation, obstruction, and spreading out of the bladder.

In the rupture of the membranous urethra, the contrast media is arrested at the level of the injury and diffuses throughout the perineum. There is a cystogram of the bladder in these cases.

When the urethra is not injured and appears normal throughout its length but the bladder is involved, 2 types of pictures may be obtained. The most frequent type shows the obvious modification of the bladder morphology on injection of the contrast media. In rarer cases, the picture obtained gives information on the integrity of the urethra, but the bladder outline is not normal. The immediate injection of contrast media is pushed without fear. The bladder outline stands out and the lesion is apparent.

The average traumatic lesion causes the bladder to be elongated—pear-shaped—extending high in the pelvis in the midline, large, high, and rounded.

with an elongated bladder neck. The compression and elevation of the bladder is caused by the effusion of blood and edema about the large mass of liquid in the bladder. The perforation is apparent from the pictures. If it is in the base (paravesical), the contrast media diffuses about the bladder neck.

If the rupture is high and posterior the picture is that of a diverticulum on the posterior superior aspect of the bladder. The contrast media is blocked by perivesical edema and the intact peritoneum. In examining this picture, the question arises as to whether there is an intraperitoneal communication with the bladder. In perforations at the base, the peritoneum is not involved. In the high posterior perforations, it is necessary to explore the peritoneal cavity by operation to obtain information as to whether the rupture has extended into the peritoneum. In the extensive type of bladder rupture the most important sign is the wide diffusion of the contrast media which is 'archaic' and nonlimited. If the peritoneum is not ruptured the bladder fills it is soft and flaccid without reaction, and the contrast media descends into the base of the pelvis. When the peritoneum also is ruptured the contrast media transverses the elongated urethra, is injected into the stump of the bladder and diffuses extensively throughout the pelvis and the peritoneal cavity as well as the iliac fossa. The liquid oil is seen swimming above the bloody urine in the peritoneal cavity.

The author outlines the roentgenological signs for rupture of the bladder. The direct signs are a diverticulum superimposed on an elongated high bladder, an elongated bladder neck, and the pear-shaped bladder suggesting the usual type of vesical rupture. When there are signs of massive effusion of the contrast media from the pelvis, and occasionally into the peritoneal cavity or diffusion into the bas-fond of the pelvis with a flaccid bladder extensive vesical rupture is present. The indirect signs are elongation of the bladder neck and elongation and erection of the bladder (like a banana, pear or child's balloon). This type of picture suggests to the author a limited parietal lesion. In brief the morphological modification of the bladder outline and the bladder neck caused by the large overflow of bloody urine associated with spasm of the vesical detrusor along with the signs of pelvic diffusion of the contrast media, are the x ray signs of probable vesical rupture. The positive signs of intraperitoneal rupture are massive diffusion of the contrast media spreading into and throughout the peritoneal cavity. The formation of a diverticulum of contrast media in the superior posterior portion of the bladder suggests intraperitoneal vesical rupture and demands careful surgical exploration.

In résumé, the author advises immediate cystourethrography following bladder rupture. The roentgenograms give valuable information as to the site of the vesical rupture and its extent and whether the injury is intraperitoneal or extraperitoneal.

CONRAD A. KUTZIN, M.D.

**Plastic Operations on the Neck of the Bladder for the Cure of Incontinence in Complete Epispadias (Plastica del collo vescicale per la cura dell'incontinenza in soggetto con epispadia completa)** ROSSARIO FINOCCHIARO *Arch. Ital. urol.* 1947 22 106

Several methods used in the treatment of complete epispadias employ modified techniques. Their disadvantage lies in the fact that they cause irreparable cicatricial alterations and furnish poor esthetic results from the sexual point of view, a nonerectile organ results and finally the incontinence cannot completely be controlled.

In a 13 year-old boy with complete suprapubic epispadias, the author employed the following procedure.

The urinary bladder was exposed with a long median incision and the pubovesical ligament was severed in order to visualize the lower portion of the bladder. This lower vesicourethral portion was plicated in a longitudinal direction by means of two 'u' shaped sutures placed in a transverse direction.

The patient regained the ability of voluntary micturition and the frequency and quantity of the urine became normal. The amount of residual urine did not exceed between 6 and 7 c.c. Postoperative roentgen ray examination showed a satisfactory reconstruction. Nocturnal incontinence was completely eliminated, and diurnal incontinence was improved.

ARTHUR F. CINOLLA, M.D.

**Multiple Vesical Tumors Characteristic of Hypernephroma (Eccezionale tumore multiplo vescicale a caratteristiche ipernefroide)** ROSSARIO CACCINI *Arch. Ital. urol.* 1947 22 69.

A patient 47 years of age had multiple vesical tumors in which the structure was not that of the bladder. This caused difficulty in the interpretation of the genesis of the tumors.

The cellular elements constituting the neoplastic parenchyma had a resemblance to the cells of the suprarenal cortex. Aberrant germ cells of the suprarenal gland were considered to be the origin of these tumors. Each tumor was identified as an endothelioma, thus, the author hypothesizes the tumor may have had its origin from embryological epithelium.

Cystoscopic examination on this patient revealed neoformations of various sizes ranging from a large pea to a hazelnut on the dome and lateral surface of the bladder. Each of the six neoformations appeared distinct from the others, and was definitely not similar to the common papilloma. A biopsy revealed the tumors to be composed of specialized epithelium.

The patient was operated upon and the bladder wall covering the area of the tumors was excised. Previous to the bladder repair a Pezzer catheter was introduced. A tubular drain and iodoform gauze was placed in the space of Retzius.

Gross examination revealed the tumors to be of a meaty to deep red color in contrast to the pallid cells of the bladder mucosa. All the tumors were

acille, without any apparent infiltration of the base. Histological examination revealed a mass of polyhedral cells abundant with protoplasm. The nuclei were round, situated in the center but often they were shrunken and displaced to the periphery. Some cells had double nuclei. In some areas there was abundant vascularization with capillaries and precapillaries filled with blood among the mass of cells. Dimensions of the cells varied from 6 to 7 microns to from 18 to 20 microns. Not a single section was similar histologically to the normal bladder. Although not encapsulated the cells were well limited; they occupied the submucosa with a distinct line of demarcation at the premuscular connective tissue.

ARTHUR F. CITOLLA, M.D.

**Penoscrotal Hypospadias.** JORDY R. HARR. *J Urol* Balt., 1948, 59: 414.

The author describes a three stage operation for the repair of hypospadias. An incision is made just below and along the ventral base of the glans. All constricting fibrous tissue which includes remnants of the corpus spongiosum, is carefully dissected away. The foreskin is then incised around the glans and a transverse buttonhole is then made in the foreskin, as suggested by Nesbit. The foreskin flap is pulled over the glans and allowed to drop down like an apron over the denuded area on the ventral aspect of the penis. It is fixed in place with interrupted No. 000 catgut sutures.

At the second stage the pendulous urethra is reconstructed according to the method of Duplay. The urethral tube is then rotated and anchored with silk sutures to prevent an overlapping of the urethral and cutaneous suture lines.

At the third stage the perineal meatus is closed over a 14 F catheter which is either removed or left in situ for 24 hours.

The sutures are placed over rubber tubes on either side of the perineal closure to support the suture line.

In the case reported there was an interval of 15 months between the first and second stages and 9 months between the second and third stages.

The urine is not diverted.

FREDERICK A. LLOYD, M.D.

**Repair of Hypospadias.** DONALD R. SMITH AND HARRY M. BLACKFIELD. *J Urol* Balt., 1948, 59: 404.

Although the hypospadiac penis presents a penile and urethral defect, the relatively gross techniques of urologic surgery cannot properly be applied to its repair. It is a problem in reconstruction, and the fundamental principles of plastic surgery should be utilized.

A proper result must above all, afford a straight penis. The urethra must not terminate posterior to the base of the glans, and its caliber should be of such dimensions that urethral dilatations are unnecessary after its construction. The principles of plastic surgery involved include the use of skin flaps

with broad bases to insure adequate blood supply, the gentle handling of tissues, careful hemostasis, lack of tension upon suture lines, the application of pressure dressings to insure proper approximation when skin flaps are used, the use of fine suture material and the absence of juxtaposition of the suture lines of the newly constructed urethra and of the covering skin flap.

The authors employed the operation of Vilray Blair. They have modified the second and third stages to simplify the procedure.

At the first stage the skin is dissected widely from the ventrum of the penis so that complete removal of fibrous bands can be accomplished. Preputial skin is then swung onto the ventrum whose area has been increased by the correction of the chordee. At the second operation a pendulous urethra of generous caliber is formed after the method of Duplay. It is constructed down to a point just distal to the hypospadiac orifice and the denuded ventrum is covered by a flap of scrotal skin whose base is left attached to the scrotum. The final procedure allows of the freeing of the penis from the scrotum, and the proximal end of the new urethra is anastomosed to the abnormal urinary meatus.

The correction of the chordee should be performed when the boy is about 18 months of age so that the corpora cavernosa will develop normally. The second stage is performed when the patient is 4½ years old and the final step before he is 5.

FREDERICK A. LLOYD, M.D.

**Radiation in Peyronie's Disease.** ROBERT E. FRICK AND JAMES H. VANNEY. *J Urol* Balt., 1948, 59: 627.

Fibrous plaque of the penis disturbs no vital function and is not a serious condition, however. It tends to cause severe mental distress and every effort should be made to cure the condition. Usually the disease occurs in middle-aged patients. It appears to be a self-limiting process. Although formerly this was considered an extremely rare disease many more cases have been reported in recent years.

The etiology is not known. Microscopic examination of excised fibrous plaques presents a picture resembling that of keloids elsewhere in the body. Hence trauma due to previous infections, passage of sounds, or some other factor may well be the cause.

Although the present methods of treating Peyronie's disease are unsatisfactory, radium therapy, by the technique employed in the treatment of keloids, appears to be worth while. More than one-half of the patients treated should receive definite benefit. Radium treatment of 141 patients over a period of 6 years is described. 44.6 per cent of the patients treated were not benefited, but the remainder were helped.

The age of the patient, the duration of symptoms before treatment, and the number of treatments given did not seem to be factors definitely influencing the result.

## GENITAL ORGANS

**Carcinoma of Prostate.** JOHN B. WEAR and A. P. SCHOENENBERGER. *J. Urol.*, Balt., 1948, 59, 587

The authors present an analysis of 383 cases of carcinoma of the prostate, which have been followed at the Wisconsin General Hospital, Madison Wisconsin, from 1933 to 1943 inclusive.

A comparison of the end-results following various methods of treatment is difficult since the indications for treatment were not precisely the same. Thus, a graphical presentation purporting to show the relative survival would not be a true curve since metastasis was present in 80 per cent of patients receiving one type of treatment, and in only 25 per cent of those receiving another type of treatment. With any form of treatment there will always emerge a few patients (of a group) who live for many years. It seems evident that prostatic carcinoma is extremely slow-growing in isolated instances. On the one hand the method of treatment is given unfair credit, on the other hand, we are dealing with patients of advanced age who are subject to all the degenerative diseases and even without carcinoma many of them would die of other lesions, but once the diagnosis of carcinoma is made that is given as the cause of death on the death certificate.

Seventy-seven patients had had no treatment at all or at the most only palliative treatment. Nearly all were seen prior to 1940. Usually these patients were poor surgical risks or they had advanced carcinoma without pain. They survived for an average period of 8 months following diagnosis, or 33 months from the onset of symptoms. 6 of the group lived more than 4 years from the onset of symptoms.

Twenty-one patients were treated with suprapubic cystostomy only. The patients in this group had marked obstructive uropathy and advanced renal damage. The operation did not prolong the life of the average patient and the authors believe that no great benefit was gained.

Twenty-five patients received roentgen therapy alone which was never given with intent to cure. However, some relief of the pain associated with metastatic lesions was obtained in about 50 per cent of the patients for varying lengths of time. In the future this form of therapy will be relegated to a minor role inasmuch as estrogens and orchiectomy will be tried first.

In 3 cases a suprapubic prostatectomy was done following a diagnosis of benign prostatic hypertrophy. On examination of the glands removed a diagnosis of carcinoma was made.

Transurethral resection was performed in 143 patients. Only 21 per cent of this group showed metastasis on admission. They all carried over 150 c.c. of residual urine, the prostates were enlarged, and in many cases the carcinoma had spread beyond the capsule. The authors definitely feel that the average life of the patient was prolonged. They report a 5 year survival in 9 per cent of this group. 5 patients survived 5 years, three 7 years and three, 9 years.

These patients are all symptom-free. It is believed that transurethral resection has a definite place in the treatment of carcinoma and that it is the treatment of choice in patients with obstruction, in whom the lesion is too advanced for perineal enucleation.

Radical perineal prostatic resection was performed on 16 patients. Before the patient was subjected to the operation the following criteria were demanded: (1) the gland had to be freely movable (2) there could be no evidence of metastasis (3) the patient had to be a fair surgical risk and have a good life expectancy. The operation probably should not be performed after the seventh decade of life. Eight of the 16 patients are still alive. 3 of the 8 recently have had orchiectomy for metastasis; the remaining 5 appear to be in excellent health although some are taking stilbestrol, without evidence of recurrence or metastasis. In the authors' opinion this operation offers the only chance of cure.

One hundred and three patients received endocrine treatment in conjunction with surgical methods. 23 patients received endocrine therapy alone. The patients who received endocrine treatment do not present a homogeneous nor a closed group. The present group was unselected and the patients have been followed up. It has been observed that up to 80 per cent of patients respond to this form of treatment for varying lengths of time, some dramatically within a few days. Immediate results were more frequently noted following orchiectomy, particularly the amelioration of pain. Estrogen therapy did not prove to be a useful supplement in cases of failure with orchiectomy. The authors are using stilbestrol in the treatment of all lesions definitely diagnosed as carcinoma, and orchiectomy is reserved for those patients who show objective evidence of metastasis. They believe, from this study that estrogenic therapy combined with transurethral resection is the operation of choice for prolongation of life and relief of pain. Early radical perineal prostatectomy is just as safe and offers the hope of cure in about 4 per cent of the patients seen.

ROBERT O. BRADLEY, M.D.

**Metabolism of Estrogens in Prostatic Cancer**  
JAMES A. MAY and BENJAMIN F. STRAUSS. *J. Urol.*, Balt., 1948, 59, 396.

In view of the remarkably beneficial effect of estrogen therapy in patients with carcinoma of the prostate it seemed profitable to the authors to study the capacity of these individuals to metabolize therapeutic doses of the natural estrogens. It was believed that such studies might uncover some abnormalities peculiar to patients with prostatic cancer and knowledge of their existence might be useful in the diagnosis or prognosis of the disease.

The application of the authors' procedure for the fractionation and photometric estimation of the urinary estrogens (estradiol, estrone and estriol) in a small series of cases with and without carcinoma of the prostate, following the administration of single therapeutic doses of the natural estrogens, revealed (a) that there is no consistent difference in the total

estrogen excretion (b) that the presence or absence of the testes appears not to alter the total excretion of the estrogens nor the relative distribution of estradiol estrone and estriol in the urine and (c) that the patients with carcinoma of the prostate showed a tendency to convert exogenous estrone into estriol more readily than did the patients without cancer

FREDERICK A. LLOYD, M.D.

**The Efficiency of Estrogens on Cancer of the Prostate** (Die Wirkung der Oestrogene auf das Prostatacarcinom) RUDOLF GEISENDORFER *Arch. Gynec. 94:7 1937*

The author quotes Walther, whose postmortem examinations revealed an incidence of 30 per cent of cancer of the prostate after the fortieth year of age. He also states that the therapeutic means of transurethral resection, deep roentgen therapy and radical operation did not come up to expectations. In a review of chiefly Anglo-American bibliography he compiles 1,003 cases in which the patients were treated with estrogens, to which he adds several hundred cases, of Palazzoli in which estrogen therapy was employed.

The author reports his own experience with 20 cases observed since 1944, first at the Surgical University Clinic of Heidelberg and then at Frankfurt. In 3 of his cases castration was performed; 1 patient was treated with implantation of 50 mgm. of ovocyclin (25 mgm. in each rectus muscle); 6 patients were treated with injections of cyren B forte, first in a dosage of 1 ampule (2.5 mgm.) every third day, later every second day, and eventually daily; a histological diagnosis was made in 10 cases and bony metastases were present in 3 cases. The average residual was 200 c.c. The first clinical symptoms appeared in from 6 weeks to 6 years before treatment and the average age of the patients was 66.9 years. The patients were observed over a period of from 14 days to 16 months. Additional therapeutic procedures consisted of 8 transurethral resections, 1 suprapubic prostatectomy plus electrosurgical operation, 1 suprapubic prostatectomy and transurethral resection, suprapubic cystostomy, deep roentgen therapy in 3 cases, and treatment with indwelling catheter in several cases. Eight patients died, 4 of these within the first 4 months. Only 7 patients received roentgen therapy regularly and 3 of these had been castrated. The weight increase was 1.5 to 10 kgm. The residual decreased to 5 c.c. Some relief from dysuria was obtained in 3 cases. Local findings revealed decrease in size, softening, and recession of infiltration in 5 cases; in 5 cases the condition remained unchanged; in 5 closely observed cases the condition improved; in 3 patients and deteriorated in 2 of 8 patients with "rheumatic complaints," 5 were improved, 2 were symptom-free and in 1 patient there was no change. The general condition improved in 18 patients, and swelling and tension in the breast occurred in 7.

The author states that all available estrogen preparations have been found efficacious with the excep-

tion of pro-estrogen  $\alpha$ -di-(p-actocyphenyl)- $\beta$ -phenyl-bromacethylen.

The dosage of estrogen administration by various authors per day and per week is reviewed. The total dosage of estrogen is also reviewed; it varies with different authors from 75 mgm. to 1,546 mgm. The importance and significance of regular acid phosphatase tests for proper dosage is stressed. The author compares injection therapy with oral and implantation therapy and he hopes that the latter two methods of application will eventually replace injection therapy. He mentions estrogen therapy by castration; its favorable result upon pains due to bony metastases was confirmed in 3 cases. The increase of weight due to hormone therapy is explained on the basis of castration. The decrease of pain due to bony metastases in the presence of progressive metastases is explained as a direct action upon the pain pathways. The author states that this requires further investigation. The improvement of the general condition is explained on the basis of the direct action of hormones on the primary tumor. The decrease in size, softening, and even the disappearance of nodes is confirmed. This involution was studied histologically by Nesbit, Parsons, and Cummings, and accounts for the decrease of the residual.

The author differentiates three parts of the prostate: the first, or the regenerative, commissure which lies between the bladder and the ejaculatory ducts; the second or pregenital, commissure which lies below the ejaculatory ducts and the third or anterior commissure which is situated in front of the urethra. He calls the first the "endogland" and the second and third the "exogland." From his experimental work he reports that the exogland responds to estrogen administration with atrophy and shrinkage whereas the endogland reacts to the same substance with proliferation.

If the cancer originates from the exogland (as is usually the case according to Bibus and others) the effect of estrogen therapy is obviously self-explanatory. The cancers which resist estrogen therapy may originate in the endogland. This would concur with the experience of Huggins, of failure in 5 per cent of patients treated with estrogens. If one considers a bony metastasis as dispersed cells originating from the exogland, the efficiency of estrogen therapy on the metastasis is explainable. It is difficult to explain why estrogen therapy or the effect of castration exhausts itself after 11 to 16 months, and the author quotes Huggins, according to whom the adrenals are playing a responsible role after castration.

Finally the author compares the experience with estrogens and with estrogens or castration, as published in the literature. The results are in favor of the estrogen and castration therapy. He concludes his remarks with the statement that a considerable prolongation of life and in a few cases apparently a true cure can be achieved by the application of estrogens in cancer of the prostate.

ERNEST BORN, M.D.

Twenty-Seven Years of Prostatic Surgery at Bellevue Hospital JOHN W. DRAPEL, *Surgery* 1948  
23 515.

During the past quarter of a century many bitter arguments have been waged concerning the relative merits of the various methods of operative treatment for benign prostatic hypertrophy. Many changes have taken place in the methods used during these years of discussion and development of new operations. It seems appropriate therefore at this time to evaluate the progress which has been made. The study presented includes all patients with benign prostatic hypertrophy treated surgically at Bellevue Hospital New York between 1920 and 1946. The chief interest lies in the comparative mortality rates for the early follow-up records were inadequate for statistical analysis.

Tables and figures have been arranged to show the total number of patients with benign prostatic hypertrophy operated upon during each of the 27 years, the annual mortality rate for all operative procedures, the annual mortality rate for transurethral resection for the second stage of a two-stage prostaticotomy alone. A study was made of the 222 consecutive patients treated in the 27 year period all postmortem reports were reviewed.

It should be noted that at Bellevue Hospital no patient is denied operation if such treatment in the opinion of the staff holds any hope of success even though this practice may increase the operative mortality rate. Many comatose patients are taken to the operating rooms and a sufficient number of them survive to justify cystotomy even in the presence of coma when an indwelling catheter is not tolerated or for some reason catheterization is impossible.

A two-stage prostaticectomy has generally been considered the operation of choice in patients who are not good surgical risks and during the early years of this report a two-stage procedure was used for all patients save those in very good condition. The latter were treated by one-stage prostaticectomy or transurethral resection. At the present time patients are treated by a transurethral resection perineal, or a one-stage prostaticectomy with the exception of those with severe uremia infection and those with strictures.

The gradual lowering of the mortality rate for the second of a two-stage operation in the past 25 years cannot be attributed to great improvement in technique but must be an index of the value of supplementary therapy.

A review of these figures gives the impression that the merits of the one-stage procedure was proved years ago and overlooked for many years until recently.

It has become the policy at Bellevue Hospital to reserve transurethral resection for glands which it is anticipated will weigh less than 50 gm. This is the only limitation of its use and often patients with severe cardiac disease and elderly debilitated pa-

tients are subjected to this procedure as a matter of choice.

Prostatectomy by the perineal route has been carried out in only 81 cases during the past 27 years and 13 of the 81 operations were done in 1946. There has been little enthusiasm for this approach to the prostate gland and there have been years in which no perineal prostatectomies were done and in other years there were only one or two. The infrequent use and unpopularity of this procedure is reflected in the mortality rate which averages 19 per cent for the 27 years an appallingly high figure.

It should be stated that 12 patients were subjected to perineal prostatectomy in 1946 by the technique advocated by Elmer Belt, without one death.

It is obvious from reviewing the records of Bellevue Hospital for the past 27 years that more patients are being subjected to prostatic surgery each year and a smaller percentage are dying as a result of their surgery. The over all mortality has dropped from 40 or 50 per cent in the early twenties, to 4.6 per cent in 1946. This is a most gratifying record and is attributable to the ingenuity industry and surgical skill of a large group of urologists who have worked during the 27 years for no greater reward.

JOHN E. KIRKPATRICK, M.D.  
R. J. SILVERTON  
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The author's personal conviction is that the ideal anesthetic for prostatic resection is a fairly low level of spinal analgesic cover namely up to the symphysis pubis.

**Rupture of the bladder.** When this occurs under any form of general anesthesia, all we are cognizant of is that some degree of shock has taken place, but the exact diagnosis of the mishap cannot be made at once. Under lumbosacral cover of spinal analgesia or iliac fossa the patient experiences pain usually in one groin site side but remaining low in the abdomen although intraperitoneal rupture, severe pain is felt in the epigastric region, and the author has had 2 cases in which both types of rupture occurred, the lower pain coming on a little earlier than the upper. On palpation great tenderness is felt in the regions named and in the case of intraperitoneal rupture distinct muscular rigidity occurs.

In cases in which the mishap is recognized at once, treatment can be instituted immediately and this is an inestimable boon, for in this way death is prevented. Pentothal should be administered intravenously and the bladder opened suprapubically. In one or two cases the author inserted an illuminated Young's boomerang needle, but in all other cases simple cystostomy with a dePezer drain allowed perfect healing of the bladder wall and return of the shocked patient to bed in quick time. As the accident usually occurs near the end of resection a large



plain catheter or better a Bardex bag catheter is left in the urethra. The prevesical and paravesical spaces are drained by two moderately fine rubber tubes.

*Damage to the external sphincter.* There is no danger to life from this mishap but the most severe cases are curable only with great difficulty. If at all, and lifelong disability to the patient may result, with worry and loss of reputation so far as the surgeon is concerned.

It is well known that the lateral lobes of the adenoma extend distally as far as, or a tiny bit beyond, the colliculus seminalis. This applies all around the circle and one must not exceed this limit whether resecting on the rectal lateral or pubic aspects of the canal, for a little beyond the colliculus is the membranous portion of the urethra with its intimately surrounding sphincter muscle.

In all cases of incontinence the patient should be instructed in the exercise of voluntarily interrupting the stream several times during each urination. Exhibition of belladonna and ephedrine may also help. In the early stages the patient should lie down a good deal and also pass urine fairly frequently to prevent too great distention of the bladder. If no improvement occurs after a few months, the patient will find it a great comfort to wear a penile incontinence clamp when up and about, for he is usually not incontinent when lying down; at least the author has not seen such a case. Moreover the patient is usually continent when sitting, and this is helped by crossing the legs. The patient is asked to wear the clamp as little as possible. When he is at home, the towel method or rubber urinal, may be convenient and prevents distention of the urethra.

In the days of perineal prostaticectomy Hugh Young described an approach by superficial perineal urethrotomy through the bulbous urethra to resect a portion of the floor of the membranous urethra, with re-suture to narrow the canal and repair the external sphincter. Another possibility is to pass a sound and approach the membranous urethra by Young's deep perineal dissection, remove a portion of its floor and close the canal again. All neighboring muscles including the anterior margins of the levatores ani may be brought together under the membranous urethra tightly, as a supporting hammock. It is theoretically safer to provide suprapubic deviation of the urine during the early convalescence after this operation, but a small catheter in the urethra should not interfere with its success. At the present time, the author would use for this purpose a 16 F Foley retention catheter to be retained for 10 days.

*Stricture of the urethra.* The author has seen this mishap occur in the penile portion of the urethra. The bulbous portion is normally relatively wide, and is not likely to be affected. The author has not yet seen stenosis of the membranous portion and the internal meatus is well opened up by the resection. In cases in which he has had the opportunity of inspecting and palpating the internal meatus at cystotomy later it has been found nicely open.

In patients with a small penis or a relatively narrow urethra, one should by-pass the penile urethra by resecting through a perineal urethrotomy or using the 24 F resectoscope. The latter should not be done, however unless the resectoscope lies loosely in the canal. In diagnosis, the 24 F panendoscope should not be used routinely for, if the urethra seems narrow when sounds are carefully passed, the dilatation should stop at about 18 to 20 F and a panendoscope sheath of one of these sizes should be used. If resection is then decided on, one may do it at once through perineal urethrotomy or wait 3 days or so, when the urethra should take the 24 F resectoscope easily.

*Hemorrhage.* The author prefers rapid resection stopping at once to coagulate all definite spurs which cause the fluid medium to turn even a moderately deep red. One should avoid cutting into the finely striated compressed true prostatic tissue for fear of awkward venous bleeding if one gets out to the true prostatic capsule. The multitude of little vessels on the vesical slope of the resected internal meatus should be coagulated carefully at the end of the operation, for they will not be controlled by a bag catheter and blood may seep slowly into the bladder later causing clots to form which may not be driven out by the gentle drip method of irrigation. These clots cause much irritation, and even vesical pain and interfere with free drainage through the catheter. Similarly, at the cut distal edge of the prostatic cavity at the level of the colliculus all vessels should be carefully coagulated otherwise a continuous and annoying seepage of blood will run down to the external meatus.

Ever since Mortensen, of Melbourne introduced to the author the idea of bag catheter hemostasis (near the end of 1945) he has considered this method indispensable to a smooth, untroubled convalescence. The best catheter is the one with a pyriform bag, and in most resections the 22 F catheter is sufficiently large. Its bag dilates up to about 40 c.c. If the resection is a large one, the 24 F catheter with bag dilating to about 70 c.c., is useful. When the catheter is inserted it is well pushed in and a continuous stream of water is kept flowing in and out then the bag is inflated to about 1 c.c., and is pulled right into the prostatic cavity where it remains in position without traction if inflation is completed up to the estimated capacity. About 10 ounces of water are left in the bladder, and the two outlets are spigotted. A continuous boric drip, controlled by a Murphy drip regulator is instituted immediately the patient gets to bed and the drip is regulated to a slow drip when all pink stain disappears, but is accelerated if slight bleeding is observed. The catheter is removed (after deflation of the bag) in 4 days.

Later or secondary hemorrhage is rare in these days of efficient electric and rubber bag hemostasis, but treatment is the same as that described. Sulfonamides during convalescence, with penicillin added if desired has also minimized the tendency to hemorrhage by reducing infection. JOHN A. LOFF, M.D.

### Immediate Prostatectomy for Retention of Urine.

G. A. BAOOR WALTERS. *Brit. M. J.* 1948, 1: 638.

In recent times so many different procedures have been advocated for dealing with benign prostatic hypertrophy that it is becoming increasingly difficult to estimate the value of new methods of treatment. This difficulty has been simply shown by the conflicting views expressed at discussions which took place in 1946 at the Medical Society of London and at the Annual Meeting of the British Association of Urological Surgeons. It seems important therefore for surgeons employing new methods to publish their results so that their experiences may be shared by others and this reason prompted recording a small series of cases.

Admittedly it is difficult to draw conclusions from a small series of cases and, owing to the advent of new sulfonamides and penicillin the three series quoted here are not strictly comparable. However the figures shown give strong support to the theories put forward by Wilson Hey (1945) who maintains that "postoperative uremia is due to infection and is encouraged by any method of slow decompression, open drainage, or instrumentation. It has been the author's experience that patients catheterized before admission were far more apt to give trouble during their convalescence."

If only selected cases are submitted to radical operation a low mortality rate can be obtained, but emphasis is laid on the fact that all cases are included in this report, and some were extremely sick patients and really deplorable operative risks.

The benefits of immediate prostatectomy for the patient with retention of urine are very great for he is spared prolonged, and sometimes painful, preoperative treatment and a long illness. Some notice must also be taken of the economic factors involved as the rapid recovery of patients is most necessary at the present time, when there is such a shortage of hospital beds.

Attention to details in treatment is of paramount importance, for even a comparatively trivial set back, such as a blocked catheter may have serious consequences in elderly and decrepit patients. All patients get out of bed the day after operation, and to this practice may be attributed the low incidence of chest complications. The majority of patients go home in good condition about the twelfth to the sixteenth day.

A consecutive series of 141 cases of benign prostatic hypertrophy is recorded. 138 were submitted to radical operation.

Except on very rare occasions drainage before operation, whether by catheter or suprapubic tube is not considered necessary or desirable.

There were 97 cases of retention of urine. Wherever feasible these patients were treated by immediate prostatectomy. 7 (7.2%) died. 70 were operated on for acute retention, with 4 (5.7%) deaths.

As many patients were admitted in very poor condition the results shown are considered satisfactory. It seems that the method of immediate

prostatectomy is well worthy of an extended trial.

JOHN E. KIRKPATRICK, M.D.

### Retropubic Prostatectomy

OSWALD S. LOWMEYER and ALBERTO GENTILE. *J. Urol.*, Balt., 1948, 59: 581.

The authors report the results obtained in 28 patients on whom retropubic prostatectomy was performed. The technique employed was similar to that used by Millin except for the method of hemostasis and drainage of the bladder. Spinal anesthesia was used.

With the patient in the Trendelenburg position a midline suprapubic midrectus incision is made. The peritoneum and prevesical fat are drawn upward. The anterior surface of the prostate is next exposed. gauze is packed on either side of the prostate to elevate this structure. The veins lying over the anterior surface of the prostate are clamped, ligated and divided. A transverse incision is made in the prostatic capsule. The adenoma is removed by blunt dissection after the urethra has been cut near the apex of the prostate, and the vesical attachments have been severed. The posterior lip of the vesical orifice is sutured with No. 0000 chromic catgut. A No. 24F 30 c.c. Foley bag catheter is introduced through the penile urethra and brought out through the prostatic cavity. Gelfoam saturated in thrombin is placed around the bag and secured in position. The bag portion is placed in the prostatic fossa and the latter is closed with No. 1 interrupted chromic catgut sutures. The hemostatic bag is distended and the wound is closed with a small drain in the prevesical space.

Twenty-eight patients were operated upon by this method. Twelve of the patients were from 52 to 59 years of age. 8 were from 60 to 69 years. 7 were from 70 to 79 years and 1 was 82 years of age.

The smallest mass of tissue weighed 8 gm. and the largest weighed 100 gm. In 11 cases the tissue weighed from 20-39 gm. in 10 from 40 to 89 gm. and in 3 from 90 to 100 gm.

The authors state that the operation is difficult to perform when the prostatic tissue to be removed weighs less than 30 gm. Enucleation is laborious. The plane of cleavage being poorly established but the amount of capsule remaining makes closure difficult. There was no operative mortality in the 28 cases. The average postoperative hospitalization was 9½ days. Usually the catheter is removed on the fourth postoperative day and the patient is discharged from 4 to 6 days later. Patients must be asymptomatic before they are discharged.

In 30 cases (71 per cent) the catheter was removed on or before the fourth postoperative day. The catheter was never removed until the urine was completely clear. In the authors' experience early removal of the catheter has not predisposed to the formation of a suprapubic fistula.

All patients were mobilized as early as possible. More than one-half of the patients were allowed up in a chair the day after operation. In 86 per cent of the patients the Penrose drain was removed on

or before the third postoperative day. In 93.7 per cent of the patients the suprapubic wound was completely dry by the fifth postoperative day. The first two patients in whom the authors used the electrocautery for hemostasis, had profuse postoperative bleeding. In the remaining 26 cases, hemostasis was secured as previously described. Of these, 21 patients had clear urine on the second day. No case of postoperative incontinence or of retention of urine was encountered. Sexual ability is not impaired to any greater degree than after suprapubic prostatectomy.

The authors list the advantages of the retropubic method of approach but state that the method is no panacea, and suggest that the type of operation should be dictated by the nature of the lesion present. The indications and contraindications for the transurethral approach, suprapubic approach, the perineal method and the retropubic method are discussed. The report contains not only a description of the operation but also many excellent drawings.

PETER L. SCARDINO, M.D.

**Retropubic Prostatectomy** SAMUEL K. BACON, J.  
*Urol., Balt., 948, 59, 376.*

The technique of retropubic prostatectomy is described and the author's experience with this procedure in 32 cases is reviewed.

The features of the operation as described by Millin are as follows: (1) retropubic prostatectomy is an extravesical procedure; (2) it is applicable to all types of prostatic obstruction; (3) it is relatively short and shock-free; (4) it appears to be anatomic ally sound and does not endanger any important organs; (5) the whole of the obstructing tissue is removed; (6) the postoperative course is easy for the patient and attending staff; (7) the postoperative stay in the hospital seldom exceeds 2 weeks; (8) the mortality rate is singularly low.

After spinal anesthesia the bladder is lavaged and emptied. Starting over the symphysis pubis, a 2½ to 3 inch longitudinal incision is made through the skin, subcutaneous tissue and fascia. The recti muscles are separated in the median line exposing the prevesical space. With the index fingers the loose areolar and adipose tissue and peritoneum are gently reflected upward. This maneuver readily exposes the anterior surface of the prostatic capsule. A self retaining retractor is introduced to separate the recti widely and the upper blade is attached to retain the bladder upward and posteriorly.

It is essential to study the distribution of veins on the anterior and lateral aspects of the prostate. Approximately 8 inches of 4 inch gauze is packed gently into each lateral recess of the prostate against the levator ani. Any veins inadvertently traumatized should be clamped and diathermized. The central leash of veins is underrun, with Millin's boomerang needle and ligated. The lateral group on each side is similarly treated.

A curved transverse incision, convexity downward, 1 cm. distal to the bladder neck, is made with a

Bard Parker knife or diathermy electrode through the prevesical fascia and true and false capsules down to the adenoma, which is readily recognized by its typical whitish appearance. Suction is maintained to keep the field dry and to enable the operator to clamp any bleeding vessels with Kocher forceps. The plane of cleavage between the false capsule and adenoma is established by a pair of closed curved scissors. The right index finger is introduced under the capsule, directed toward the external sphincter and swept laterally and posteriorly against the prostate. Usually the urethra separates readily from the prostate, but if it resists, it should be cut transversely at the apex of the gland. The distal extremities of the lateral lobes are turned upward through the capsular incision and grasped with a tenaculum. The dissection is continued by sponging off the capsule, trigone and bladder neck, leaving free except for a cone of mucosa the latter is then clamped and diathermized. After placing a small gauze pack into the prostatic fossa the edges are secured with Millin's T-shaped angle clamps and capsule-grasping forceps. When the pack is removed all bleeding vessels are visualized and diathermized. Keeping the field dry with an open-end suction materially assists in this procedure. The bladder neck is palpated and if it is contracted or indurated, a section is excised posteriorly. A small catheter is directed through the urethra to the prostatic fossa and guided into the bladder.

Oxygel placed in the fossa insures a more complete hemostasis. The capsule is closed with a continuous suture of No. 0 chromic catgut. A small Penrose drain is directed to the capsule and the wound is closed. Irrigation of the catheter usually reveals a clear return flow with the third syringe.

The drain is removed on the third or fourth day and the catheter on the fifth day.

FREDERICK A. LLOYD, M.D.

**Retropubic Prostatectomy** TERENCE MILLIN, J.  
*Urol., Balt., 948, 59, 367.*

The author briefly reviews the history of development of the retropubic approach to the prostate and considers a few types of associated urinary tract diseases. With use of the retropubic approach apparently many of the difficulties presented by other methods of prostatectomy are overcome. Visualization of the prostatic bed is excellent. It permits the control of hemorrhage obviates the need of long uncomfortable hospitalization, suprapubic fistula and late stenosis at the bladder neck, as well as the need for excision or plastic suture of the vesical neck.

Of 50 consecutive cases, the average postoperative hospitalization was 16.6 days. Seven of the patients were handled transurethrally and one was discharged with a suprapubic tube because of renal insufficiency. Three patients with carcinoma of the prostate underwent radical removal.

Of 403 patients, only 24 required second stage retropubic prostatectomy. 3 patients were discharged with permanent suprapubic tubes. One patient died

2 months later of carcinoma of the stomach, 3 of the 3 had marked renal insufficiency. Two additional patients died following cystostomy, one from a coronary thrombosis and the other in uremia. Only 9 of the 24 patients and the other in uremia. Only 9 cystostomy by the author

Renal incompetence which fails to respond to urethral catheter drainage is handled with a suprapubic tube. Antibiotics now permit the use of catheter (urethral) drainage in the presence of gross infection. Vesical calculi are readily extracted through the vesical neck during the course of a retropubic prostatectomy. Vesical diverticula and bladder tumors offer no impediment to retropubic removal.

Of a total of 1503 retropubic prostatectomies performed in clinics throughout Europe, the average mortality rate was 5.3 per cent. The average rates transurethral resection for the fibrous prostate or median bar but the retropubic approach for removal of the calcareous prostate. Excision curettage or subtotal prostatectomy. Excision curettage by this method. The author has performed the prostate operation for operable carcinoma of the prostate 9 times. Other urological problems satisfactorily handled by the retropubic approach are (1) ruptured posterior urethra, i.e., torn apex of the prostate associated with fractured pelvis (2) exposure and excision of congenital prostatic valves (3) cure of incontinence in epispadias (4) some post-prostatectomy obstructions (5) prostatic abscesses and (6) impacted prostatic calculi.

**Epididymectomy: An Alternative Technique.** *Ann. Roy. Coll. Surg. Engl.* 1948, 10: 13.

As performed by Wildbolz, Zuckerkandl, Marion High Young and Thomson Walker, epididymectomy consisted of high ligation of the vas through an oblique inguinal incision, the extraction of the cord and testis from the scrotum via the inguinal canal, and the excision of the distal part of the vas and epididymis by dissection from above downward. With this technique it is usually difficult to be certain of avoiding damage to the spermatic vessels and there has been a tendency to seek an alternative and

Heinatz (1944) described an original method by which the epididymis was dissected free after the tunica vaginalis was opened through a scrotal incision and he used a neat maneuver to ensure that the spermatic vessels were separated from the vas and kept out of danger. A small incision was made through the tunica albuginea on the medial side of the testis adjacent to the body of the epididymis. A director was inserted and pushed up the cord and all the layers superficial to it were divided with the scalpel. The director lies within the internal spermatic fascia and the vas and spermatic vessels are preserved deep to it. In the early tuberculous epididymis this method is sound but if advanced caecation is present there is an obvious disadvantage in opening the tunica albuginea so close to an infected area.

A transverse incision 2 in. long is made through the scrotal skin and dartos of the affected side. If a discharging sinus is present this is included in the incision and the track dissected out. The three spermatic fasciae are divided in the line of the incision which displays the tunica vaginalis and the latter is opened sufficiently to allow the testis to be everted from it. The fasciae are not separated from the tunica which is turned inside out. However the skin and dartos are separated from the external spermatic fascia so as to allow the cord and its coverings above the tunica to be brought into view outside the wound. With the testis lying on its medial side a pair of straight Mayo scissors are pushed into the sinus of the epididymis and on up the cord until the points are divided with a scalpel, and the edges retracted. The fasciae overlying the separated scissor sheath the spermatic artery can then be seen beneath the scissor blades and the two branches of the epididymis are isolated, ligated and divided. With the scissors in position, the tail of the epididymis is picked up and dissected free from the testis. The body is already separated by the epididymis to the epididymis and then separated from the remaining portions of the tunica and overlying fasciae attached der as far up as the original incision on the scrotum. Those points, bleeding vessels (branches of the funicular artery) being picked up with hemostats as they are cut. The sole remaining attachment is the vas itself which is followed as far as possible up the cord before it is divided. A running suture then closes the spermatic fasciae and the skin and dartos are closed with a small drain.

## MISCELLANEOUS

**Intestinal Distention.** R. CAMPBELL BRUCE, *J. Urol.* Balt. 1948, 59: 358.

In the present article the author states that "Urologists rarely write about abdominal distention but it has given most of us a headache from time to time. As a class we are rather allergic to entering the peritoneal cavity and, if we have to do so, are glad to get out as soon as possible. We are however abdominal surgeons even if for the most part, extraperitoneal ones and as such have to face up to the problem of postoperative gas pains, meteorism and adynamic ileus. The first are distinctly unpleasant, the last two are dangerous, especially in our work, as they impede kidney function (Schneidorf and Orr 1942) at the very time we wish to maintain and foster it. The elimination of such post-operative incidents is therefore well worthy of our attention and incidentally should point the way to

JOHN A. LOFT, M.D.

or before the third postoperative day. In 92.7 per cent of the patients the suprapubic wound was completely dry by the fifth postoperative day. The first two patients in whom the authors used the electrocautery for hemostasis had profuse postoperative bleeding. In the remaining 16 cases, hemostasis was secured as previously described. Of these, 21 patients had clear urine on the second day. No case of postoperative incontinence or of retention of urine was encountered. Sexual ability is not impaired to any greater degree than after suprapubic prostatectomy.

The authors list the advantages of the retropubic method of approach but state that the method is no panacea and suggest that the type of operation should be dictated by the nature of the lesion present. The indications and contraindications for the transurethral approach, suprapubic approach, the perineal method and the retropubic method are discussed. The report contains not only a description of the operation but also many excellent drawings.

PETER L. SCARDINO, M.D.

**Retropubic Prostatectomy** SAMUEL K. BACON, J.  
*Urol. Balt.*, 943, 59, 376.

The technique of retropubic prostatectomy is described, and the author's experience with this procedure in 32 cases is reviewed.

The features of the operation as described by Millin are as follows: (1) retropubic prostatectomy is an extravesical procedure; (2) it is applicable to all types of prostatic obstruction; (3) it is relatively short and shock free; (4) it appears to be anatomic ally sound, and does not endanger any important organs; (5) the whole of the obstructing tissue is removed; (6) the postoperative course is easy for the patient and attending staff; (7) the postoperative stay in the hospital seldom exceeds 2 weeks; (8) the mortality rate is singularly low.

After spinal anesthesia the bladder is lavaged and emptied. Starting over the symphysis pubis a 2½ to 3 inch longitudinal incision is made through the skin, subcutaneous tissue and fascia. The recti muscles are separated in the median line, exposing the prevesical space. With the index fingers the loose areolar and adipose tissue and peritoneum are gently reflected upward. This maneuver readily exposes the anterior surface of the prostatic capsule. A self retaining retractor is introduced to separate the recti widely and the upper blade is attached to retain the bladder upward and posteriorly.

It is essential to study the distribution of veins on the anterior and lateral aspects of the prostate. Approximately 8 inches of 4 inch gauze is packed, gently into each lateral recess of the prostate against the levator ani. Any veins inadvertently traumatized should be clamped and diathermized. The central leash of veins is undrawn, with Millin's boomerang needle and ligated. The lateral group on each side is similarly treated.

A curved transverse incision, convexity downward 1 cm. distal to the bladder neck, is made with a

Bard Parker knife or diathermy electrode through the prevesical fascia and true and false capsules down to the adenoma, which is readily recognized by its typical whitish appearance. Suction is maintained to keep the field dry and to enable the operator to clamp any bleeding vessels with Kocher forceps. The plane of cleavage between the false capsule and adenoma is established by a pair of closed curved scissors. The right index finger is introduced under the capsule, directed toward the external sphincter and swept laterally and posteriorly against the prostate. Usually the urethra separates readily from the prostate, but if it resists, it should be cut transversely at the apex of the gland. The distal extremities of the lateral lobes are turned upward through the capsular incision and grasped with a tenaculum. The dissection is continued by sponging off the capsule, trigone and bladder neck, leaving it free except for a cone of mucosa. The latter is then clamped and diathermized. After placing a small gauze pack into the prostatic fossa the edges are secured with Millin's T-shaped angle clamps and capsule-grasping forceps. When the pack is removed all bleeding vessels are visualized and diathermized. Keeping the field dry with an open-end suction materially assists in this procedure. The bladder neck is palpated, and if it is contracted or indurated, a section is excised posteriorly. A small catheter is directed through the urethra to the prostatic fossa and guided into the bladder.

Oxyel placed in the fossa insures a more complete hemostasis. The capsule is closed with a continuous suture of No. 0 chromic catgut. A small Penrose drain is directed to the capsule and the wound is closed. Irrigation of the catheter usually reveals a clear return flow with the third syringe.

The drain is removed on the third or fourth day and the catheter on the fifth day.

FREDERICK A. LLOYD, M.D.

**Retropubic Prostatectomy** TERRACE MILLIN, J.  
*Urol. Balt.*, 948, 59, 367.

The author briefly reviews the history of development of the retropubic approach to the prostate and considers a few types of associated urinary tract diseases. With use of the retropubic approach, apparently many of the difficulties presented by other methods of prostatectomy are overcome. Visualization of the prostatic bed is excellent. It permits the control of hemorrhage, obviates the need of long uncomfortable hospitalization, suprapubic fistula, and late stenosis at the bladder neck, as well as the need for excision or plastic suture of the vesical neck.

Of 50 consecutive cases, the average postoperative hospitalization was 16.6 days. Seven of the patients were handled transurethrally and one was discharged with a suprapubic tube because of renal insufficiency. Three patients with carcinoma of the prostate underwent radical removal.

Of 409 patients, only 24 required second stage retropubic prostatectomy; 3 patients were discharged with permanent suprapubic tubes; one patient died

3 months later of carcinoma of the stomach 3 of the 3 had marked renal insufficiency. Two additional patients died following cystostomy one from a coronary thrombosis and the other in uremia. Only 9 of the 24 patients and the other in uremia. Only 9 cystostomy by the author

Renal incompetence which fails to respond to ureteral catheter drainage is handled with a supra pubic tube. Antibiotics now permit the use of catheter (urethral) drainage in the presence of gross infection. Vesical calculi are readily extracted through the vesical neck during the course of a retropubic prostatectomy. Vesical diverticula and bladder tumors offer no impediment to retropubic removal. Of a total of 1503 retropubic prostatectomies performed in clinics throughout Europe the average mortality rate was 5.3 per cent. The author advocates transurethral resection for the fibrous prostate or median bar but the retropubic approach for the removal of the calcareous prostate. Excision curettage, or subtotal prostatectomy can be performed by this method. The author has performed the radical retropubic operation for operable carcinoma of the prostate 9 times. Other urological problems satisfactorily handled by the retropubic approach are (1) ruptured posterior urethra (2) torn apex of the prostate associated with fractured pelvis (3) cure of incontinence in congenital prostatic valves (4) prostatic obstructions (5) prostatic abscesses and (6) impacted prostatic calculi

PETER L. SCARDINO, M.D.  
 Urologist, New York

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As performed by Wildbois, Zuckerkandl, Marion High Young and Thomson-Walker epididymectomy consisted of high ligation of the vas through an oblique inguinal incision of the vas through cord and testis from the scrotum via the inguinal canal, and the excision of the distal part of the vas and epididymis by dissection from above downward. With this technique it is usually difficult to be certain of avoiding damage to the spermatic vessels and there has been a tendency to seek an alternative and safer method.

Heinatz (1934) described an original method by which the epididymis was dissected free after the tunica vaginalis was opened through a scrotal incision and he used a neat maneuver to ensure that the spermatic vessels were preserved. A small incision was made through the tunica albuginea on the medial side of the testis adjacent to the body of the epididymis. The director was inserted and pushed up the cord and all the layers superficial to it were divided with the scalpel. The director lies within the internal spermatic fasciae and the vas and spermatic vessels are preserved deep to it. In the early tuberculous epididymis this method is sound but if advanced calcification is present there is an obvious disadvantage in opening the tunica albuginea so close to an infected area.

An attempt was made therefore to devise a technique by which these disadvantages could be avoided but in which the approach and maneuver of Heinatz could be utilized. The operation to be described has been evolved has proved satisfactory in practice and is now employed by the author as routine.

A transverse incision 2 in. long is made through the scrotal skin and dartos of the affected side. If a charging sinus is present this is included in the incision and the track dissected out. The three spermatic fasciae are divided in the line of the incision sufficiently to allow the testis to be evaginated from it. The tunica which is turned inside out the tunica which is turned inside out however the spermatic fascia is separated from the external inguinal ring above the tunica to be brought into view outside the wound. With the testis lying on its medial side a pair of straight Mayo scissors are pushed into the points present at a level above and on up the cord until the points are divided with a scalpel and the edges retracted. The fasciae overlying the separated scissor sheath the scissor blades and the two branches to the epididymis are isolated, ligated and divided. With the scissors in position, the tail of the epididymis is already separated free from the testis and portions of the tunica and overlying fasciae attached to the epididymis are then separated from the remaining points, bleeding vessels (branches of the funicular artery) being picked up with hemostats as they are cut. The sole remaining attachment is the vas itself which is followed as far as possible up the cord before it is divided. A running suture then closes the spermatic fasciae and the skin and dartos are closed with a small drain.

JOHN A. LOFF, M.D.  
 Urologist, New York

## MISCELLANEOUS

**Intestinal Distention.** R. CAMPBELL BEGG. J. Urol. Balt. 1948 59: 358.

In the present article the author states that "Urologists rarely write about abdominal distention, but it has given most of us a headache from time to time. As a class we are rather allergic to so are glad to get out of as soon as possible. We are however abdominal surgeons even if for the most part, extraperitoneal ones and, as such have to face up to the problem of postoperative gas pains etc. and adynamic ileus. The first are distinctly unpleasant the last two are dangerous, especially in our work, as they impede kidney function (Schneider and Orr 1942) at the very time we wish to maintain and foster it. The elimination of such postoperative incidents is therefore well worthy of our attention and incidentally should point the way to

the treatment of other forms of distended bladder and more particularly with anuria and uremia.

Most of us have learned, in the course of the years, that the gases of distention do not arise from food fermentation. They are the wrong kind of gases for that. Accordingly, the preoperative purgative and enema so beloved by nurses of the old school, have lost in popularity but still linger on from tradition rather than logic. More tenacious still is the idea that drinks should be encouraged, if not forced after urological operations, and this brings me to the very essence of my chosen subject. My thesis is that gas pains and distention, these evil harbingers of adynamic ileus, may be completely obliterated provided nothing whatever is given by mouth or rectum during the inevitable postoperative nonperistaltic period. This method has been practiced now for 10 years and has induced many of my surgical and gynecological colleagues to adopt it after appendectomies, hysterectomies, gastric and intestinal resections, and indeed all other types of abdominal operation. Many hundreds of urological and abdominal cases have thus come under observation.

"The typical postoperative course of a case handled in this way follows a very definite pattern. On his return to bed the patient has a cannula inserted into one of the veins on the dorsum of the hand, and all fluid, electrolytes, blood, protein and drug requirements, with the exception of hypodermics, are given through this. At an early stage, he is allowed to rinse out his mouth with water at room temperature, but no ice-water cracked ice, chewing gum, pineapple or any of the other popular thirst palliatives is allowed. The abdomen remains flat and comfortable but no sounds whatever are heard on auscultation. The nonperistaltic, refractory or silent period has set in, and may last for 6 hours to 4 days according to the nature of the operation, the preparation and medication which preceded it, the length of time that it occupied and the type of anesthetic given. When this silent stage terminates the patient may be conscious of intestinal activity and borborygmi can be heard in the upper abdomen with the naked ear or the stethoscope. In the course of 2 or 3 hours these sounds become generalized and flatus is passed per rectum. There is no discomfort of any sort accompanying this renewed activity in contrast to the irregular contractions and gas pains which herald the first appearance of peristalsis if fluids have been given. In fact, once the refractory period has come to an end, the gastrointestinal tract can cope, if need be with an ordinary meal, and even purgatives and enemas, though undesirable, have little untoward effect. The bowels move naturally on the fifth postoperative day or with the help of mild laxative pills on the sixth.

"The same story can be told after any operation provided mechanical obstruction is absent. Even with the onset of peritonitis, a condition rare in urological work, there may be little if any distention. One point that requires emphasis is the futility of setting a fixed time limit after which fluids may be

given. The termination of the nonperistaltic phase is easily recognizable by the nursing staff and the deleterious results of drinks and enemas are the same throughout, whether given at the beginning or towards the end. The nurse in charge should be warned that a thirsty patient may say he has passed flatus in order to be allowed fluids prematurely and should rely entirely on her own observations.

As in our cases the strict regime was rather revolutionary it was violated in some instances and gave the opportunity for several interesting observations. A single ounce of water swallowed on the second day after phelolithotomy initiated a progressive process of distention. A relieving nurse gave an enema to a nephrectomy case on the third day before peristalsis had recommenced. The result was a "blow-up" which kept the staff busy for 5 days before the patient was out of danger. Cracked ice sucked by a man for 1 hour only shortly after he had undergone an operation for hydronephrosis due to an aberrant vessel, produced an almost fatal adynamic ileus, finally relieved on the eighth postoperative day by the subcutaneous injection of 2 5 mgrm. (5 ampoules) of prostigmin given as a single dose. This confirmed incidentally, that the term "paralytic ileus" is a misnomer for after this large dose of prostigmin, the mountain-like abdomen collapsed like a pricked balloon, while the patient screamed with colic and spent the greater part of 12 hours productively occupied on a series of inadequate bedpans! The chewing of gum, and the sucking of acid drops and pine apple squares as thirst palliatives were found to be by no means harmless. In the few early cases when these were allowed, the postoperative course was not always smooth.

A theory is suggested to explain all forms of non-mechanical intestinal distention. The gases in free solution in the blood, especially nitrogen diffuse in and out of the intestinal lumen where they serve a physiological purpose. Any excess is prevented by the tonus of the bowel muscle or disposed of by reabsorption or expulsion through the action of peristalsis. When the latter is inhibited, as during and after abdominal operations, intraperitoneal or extraperitoneal, the bowel closes down on its contents and in virtue of the unimpaired high tonus which keeps the lumen at a minimum, resists the partial pressure of the blood nitrogen which would otherwise cause dilation. Should the tonus be lowered by injury or reflex action, resistance to the inflow of gases is diminished. The latter then enter and cause distention.

The entry of any fluid or food into the stomach during the nonperistaltic period which follows all abdominal operations initiates a reflex by which the tonus of the bowel is lowered making distention possible and inevitable. The condition so produced is irreversible until the return of active peristalsis, which is itself delayed by the presence of distention. Distention once begun tends to be progressive the bowel attempting step by step to relieve stragulating pressure on its blood supply

Preoperative purgatives and enemas disturb intestinal balance and tend to prolong the postoperative refractory phase. Gas pains, meteorism and/or adynamic ileus need never occur following urological or other abdominal operations provided mechanical obstruction of the gut is absent, no fluid food or drug is given by mouth, and no enemas are administered throughout the entire nonperistaltic period.

The practical application of the above principles is discussed.

JOHN E. KIRKPATRICK, M.D.

Epithelial Metaplasia FRANK S. PATCH, J. Am. M. Ass. 1948, 136 824

The finding of tissue cells of another type than those normally found in an organ of the body is always intriguing and the explanation of such an occurrence presents many difficulties. It is not strange that differences of opinion have arisen as to the exact mechanism by which such a metamorphosis of tissue has been produced.

Such changes are found not infrequently in the epithelium of the urinary tract, where they present an interesting urologic study. In this the author confines his attention to the changes occurring in the renal pelvis, the ureters, and the bladder. Although the epithelium of these organs possesses a different derivation embryologically that of the bladder and partly endodermal and partly mesodermal, they are all lined with transitional cell epithelium, and, except perhaps in the immediate neighborhood of the bladder outlet, true glands are not normally present. Metamorphosis of the epithelium in these organs is of two distinct types.

1 The substitution for the normal transitional cell epithelium of a stratified keratinizing epithelium and the development of leucoplakia and, by what may be regarded as a further extension of the process, squamous cell carcinoma. In this group the epithelial change is toward an epidermal type of cell.

2 The appearance in the mucosa of glandular formations with secretory properties, the so-called cystitis glandularis. In a striking parallelism to the preceding group there develops a mucin-secreting adenocarcinoma. In this group the change is toward an endodermal type in which is found an epithelium resembling that of the large bowel.

Leucoplakia of the renal pelvis, ureters and bladder and cystitis (pyelitis and ureteritis) glandularis are the result of epithelial metaplasia in response to a call for altered function, or at least as the result of altered environment. These metaplasias are commonly associated with chronic, long-standing irritation or infection.

Leucoplakia may follow vitamin A deficiency. In this condition it is not secondary to an infection.

The extent and intensity of the metaplastic process is in direct relation to the intensity and duration of the inciting factors.

Both conditions are potentially malignant. They may develop a malignant character by a further extension of the metaplastic process into squamous cell carcinoma and mucinous adenocarcinoma respectively.

Both types of cancer may develop primarily by acceleration or intensification of the metaplastic process. It is possible that the epithelial changes may be reversible.

JOHN E. KIRKPATRICK, M.D.



# SURGERY OF THE BONES, JOINTS, MUSCLES, TENDONS

## CONDITIONS OF THE BONES, JOINTS, MUSCLES, TENDONS, ETC.

**Salmonella Osteomyelitis; Report of a Case with Salmonella Schottmuelleri as the Etiologic Agent.**  
ROBERT C. ABRAMS and FREDERICK O. GARDNER  
*U S Nav M Bull* 1948, 48, 306.

Osteomyelitis due to any of the *Salmonella* group is a rarity according to a review of the literature. *Salmonella schottmuelleri* is the organism present as proved by culture and agglutination in an involvement of the lumbosacral spine reported by Ecker-Kuehn, and Recroft who found 3 other cases in the literature.

The case reported presented multiple foci, with unusual freedom from symptoms and rapid healing.

A 9 year old negro seaman was seen first in January, 1946 he had an acute febrile episode, pain in both humeri and 3,400 white blood count. Blood culture was reported normal. No roentgenograms were taken. After 8 days of penicillin therapy the fever and tenderness gradually subsided and the patient returned to duty after 26 days.

On February 20, a febrile episode occurred with pain in the right hip and was treated with penicillin and sulfadiazine, and by traction on the right leg. A roentgenogram of the hip showed no changes from normal.

By March 12, when the patient returned to the mainland, he was in acute pain and roentgen findings confirmed a diagnosis of acute osteomyelitis of the right femoral head. Surgical drainage released gray, thin, watery pus, and after 5 days of sulfadiazine and penicillin treatment the patient was afebrile. The wound was healed by March 28.

Blood and pus from the hip revealed gram-negative rods on culture which were thought to be contaminants and the cultures were destroyed.

Further roentgen studies revealed varying stages of involvement in both humeri, radii, tibiae, femora and the right hip joint. A biopsy of the right humerus was done solely to obtain a pure culture of the organism which, as well as serum agglutinations, was positive for *Salmonella schottmuelleri*.

No satisfactory history of early infection could be developed, although it was found that at the age of 9 years the patient had had persistent aching of his forearms.

Four months after drainage of the hip the patient was active without weight bearing and in excellent condition clinically. FRANK E. BREIDENECHE, M.D.

**Eosinophilic Granuloma.** WILLIAM J. BAKER, JOHN D. Houghton, EODON WIMBRO, and KERRY H. BEITZ. *N England J M* 94:2, 38, 69d.

A review of the literature since 1940, when eosinophilic granuloma was simultaneously described by Lichtenstein and Jaffe and by Otani and Ehrlich,

includes about 45 case reports. Eighty per cent of the patients were children the oldest patients were a man of 35 years and a woman of 50 years.

Characteristic of the disease is its increased frequency in males and its occurrence oftenest in ribs or skull. Lesions may be single or multiple but the bones of the hands and feet are spared.

X-ray findings are characteristically punched-out areas which may erode the cortex and produce pathologic fractures. Laboratory findings are usually not abnormal.

Biopsy of the granuloma shows soft, yellow tissue with some hemorrhagic, and some necrotic areas. Sheets of eosinophils are found along with phagocytic mononuclear and multinuclear histiocytes.

The case reported is that of a 30-year-old man in whom roentgenography revealed a rapid progression of the lesion. The patient had constant soreness in the right anterolateral chest wall for 6 weeks before being seen. The roentgenogram showed a small cystic area in the seventh rib, which in 4 more weeks was markedly increased in size, with cortical erosion. At 8 weeks from the time of the original roentgenogram a wide area of destruction localized to the seventh rib was visualized. A pathologic fracture traversed the area.

Partial resection of the affected rib showed typical gross and microscopic eosinophilic granuloma. A rapid and uneventful convalescence ensued. Check up in 6 months showed healing at the site of biopsy and all physical findings were normal.

FRANK E. BREIDENECHE, M.D.

**Congenital Pseudarthrosis. Follow-Up Study after Massive Bone Grafting.** HAROLD B. BOTO and KERMIT W. FOX. *J Bone Surg* 9:1, 30-A: 74.

A report was made of 7 cases in which 10 massive bone grafts were used. Bony union followed operation in all but one of these patients. The author believes that union can be anticipated in the majority of cases after this procedure. However in 3 instances refracture occurred following union. In one patient amputation was done after refracture. Bony union has been present following the second bone graft operation for 1 1/2 years, 2 years, and 3 1/2 years, respectively. Union has persisted after the first massive graft for 3 1/2, 7 1/2, and 22 years, respectively.

A refracture may be preceded by an increase in sclerosis about the fracture site, narrowing of a previously reformed medullary canal, or an insufficiency fracture. Routine follow-up roentgenograms should be made at intervals of 6 months, to determine if any of these factors are developing and, if so, surgical intervention may be indicated before a complete refracture occurs.

The authors emphasized the need for adequate bracing. This should be carried out following the bone graft until a new well developed medullary

canal has formed across the fracture site and until the tibia has reached sufficient size and strength to compare favorably with the normal one. This will usually require the use of a brace until the child is past puberty which in actual practice means a period of from 5 to 12 years.

It is the consensus that the older the patient, the greater the probability of union and that union is obtained with greater ease after puberty. However the longer the operation is delayed the more shortening will occur the leg will be poorly developed and the deformity due to anterior bowing of the leg and calcaneovalgus of the foot will be greater. It is the authors' opinion that the patient should be operated upon as early as practicable that is from 3 to 5 years of age.

At operation the surgeon should remember that the bone is small and osteoporotic. The dual graft forms a 'bone clamp' consequently it is easy to fracture the osteoporotic bone just above the ankle, at the lower end of the graft.

The type of brace advocated by Kite in which the leather sleeve laces posteriorly is superior to one laced down the front of the leg a solid well molded piece of leather on the anterior surface of the leg gives better support to the tibia, which usually has a tendency to become angulated in that direction.

Three types of patients with congenital pseudarthrosis are recognized those born with a defect in the tibia those with fractures developing in a congenital cyst of the tibia, and those born with congenital bowing of the tibia in whom the bone is small and sclerotic and the medullary canal is diminished in size, or absent. In the third type the tibia usually breaks as the result of minor trauma. Following the fracture absorption occurs and a typical pseudarthrosis results. In a patient of the third type, osteotomy to correct the bowing of the tibia should not be done as nonunion will develop.

The prognosis for fractures developing in congenital cysts is probably more favorable the bone is better suited mechanically for grafting because the ends of the bone are not narrowed and pointed as in the other two types. Also the medullary canal in both fragments is larger and consequently easier to expose and open. The choice between amputation and bone grafting may be a difficult one. It is necessary to compare the usefulness of an artificial limb with that of the extremity which can reasonably be expected after a successful bone graft, rather than with a normal leg. An expected shortening in excess of 3 inches a considerable residual deformity such as anterior bowing of the tibia and pes calcaneovalgus and the constant possibility of re-fracture of a small, weak tibia may be indications for an amputation. C. FRED GORDON, M.D.

**Primary Hemangiomas of Muscle.** I W. KAPLAN and WILFRED E. TORRESON *Am. J. Surg.* 1948, 75, 614.

Hemangiomas of the skeletal muscles is a relatively rare disease. In a series of 1,308 hemangiomas, Watson and McCarthy reported that 10 or 0.8 per cent,

occurred in skeletal muscle. Since the first reported hemangioma of skeletal muscle in 1843 some 353 cases have been reported.

The clinical picture is varied, depending upon the site of occurrence. Symptoms may persist from one year to several years. Pain, the most common symptom is localized at the site of the tumor it varies from a dull, aching fullness to a sharp throbbing sensation. The pain may be aggravated by exertion and will usually subside with rest. Palpation usually reveals a fixed mass which may be ill defined or sharply demarcated. The mass may feel fluctuant, soft, or firm more often it has a rubbery consistency. It is usually tender to deep pressure and pulsations may be detected.

The most common site of occurrence is in the muscles of the lower extremities although any striated muscle may be affected. One or several muscles may be involved.

The consensus is that hemangiomas are congenital and that trauma is frequently an important factor in activating the growth of the tumor and the development of symptoms. The condition must be differentiated from hematoma, fibroma, neurofibroma, fibrosarcoma, lipoma, hydatid cyst, myoblastoma, and rhabdomyoma. Exploratory puncture and roentgenologic studies are the most valuable aids in establishing a correct diagnosis. Phleboliths, shown by x ray films are present in about 48 per cent of the cases. Exploratory puncture reveals blood in approximately 98 per cent of the cases.

Surgical excision is the treatment of choice. The author reports a case which was of interest because the tumor involved the entire external and internal abdominal oblique muscles of the right abdominal wall, and hemangioma of muscle was considered in the differential diagnosis because of the presence of phleboliths.

C. FRED GORDON, M.D.

**Rare Sites of Primary Acute Osteomyelitis.** Ribs, Sternum, and Skull (Sed rare di osteomielite acuta primitiva coste, sterno cranio) ALESSANDRO FICAL. *Rass. internaz. clin. ter.*, 1948, 28, 44.

The author presents 3 cases of primary acute osteomyelitis. In the first patient a man 30 years of age the anterior portion of the sixth right rib was involved. The course was extremely favorable and the patient was cured in a little over one month. In 102 cases of osteomyelitis reviewed by Zampetti this localization was found only five times. In the second case a portion of the body and of the manubrium of the sternum was involved in a man 72 years of age and cure was obtained in about 40 days. The cartilage interposed between the two parts of the bone prevents the spread of infection from one part to the other its late ossification explains the rarity of this spread but in the present case the entire sternum consisted of compact bone hence the involvement of both body and manubrium. In the third case a woman 28 years of age, the left parietal bone was involved. The course of the process differed from that usually seen in osteomyelitis of the

skull it was mild during the first stage and the fever soon disappeared but 20 days after the disease began there was a second rather severe stage with meningeal symptoms which required a second intervention this was followed by improvement but 3 days later the meningeal symptoms reappeared and the general condition became bad another intervention was indicated but the family decided to take the patient home

In the last two cases the infecting agent was the staphylococcus in the first case no bacteriologic examination was made but the quality of the pus suggested the staphylococcus as the agent. The germs usually reach the bone by the blood route in the second case the original focus of infection was the first toe of the right foot and in the third case, the fifth finger of the left hand. In the first case osteomyelitis followed a blow received in a boxing match one month previously

About 100 cases of acute osteomyelitis of ribs have been reported. The disease nearly always occurs during the period of growth although quite a few cases have been observed in adults and even between the ages of 60 and 75. Osteomyelitis following typhoid fever is more frequent in adults, and it is observed in men more frequently than in women. Usually only one rib is involved and the preferred points of attack are the nuclei of ossification. In infancy the infection is usually in the anterior end of the rib in childhood and later it occurs especially in the posterior end in the cephalic point, and more often in the chondrocostal extremity. The cartilage may take part in the process (osteochondritis) by spread from the adjacent bony focus or by way of the small well vascularized nuclei of ossification or of the perichondrium.

About 30 cases of acute osteomyelitis of the sternum have been reported. The most frequent localization is in the body of the bone, but the manubrium and the xiphoid process may be involved. The abscess may work its way in various directions. Mediastinal abscess is the most frequent complication then follow in frequency the invasion of the lungs and pleura

Not more than 40 cases of primary osteomyelitis of the skull have been reported. The bones most frequently involved are the frontal, parietal, temporal, and occipital. The process begins in the diploe and spreads through the entire thickness of the tables the pus detaches the dura internally and the periosteum externally giving rise to intracranial extradural, and subperiosteal extracranial collections.

The prognosis is generally benign for osteomyelitis of the ribs, as complications are rare. In osteomyelitis of the sternum the mortality seems to reach 50 per cent owing to complications. In osteomyelitis of the skull the prognosis is mostly unfavorable because of the local and general complications (purulent meningitis, thrombosis of the sinuses, cerebral or cerebellar abscess toxemia with degeneration of various organs septicemia, etc.) Treatment can

only be surgical preceded and followed by sulfonamide or penicillin therapy. RICHARD KIMMEL, M.D.

**Perthes Disease, Osteochondritis Dissecans, and Infantile Coxa Vara Experimentally Produced in Animals.** EDWARD BURCHARDT. *Helvet. chir. acta*, 1945, 15: 3.

The cause of juvenile osteochondritis is still unknown. Perthes' disease, osteochondritis dissecans, and coxa vara show similar histologic findings but affect different parts of the proximal end of the femur. Coxa vara has its main pathology in the metaphysis while Perthes' disease and osteochondritis dissecans affect the epiphysis predominantly. Histologic sections show an irregular arrangement of new bone formation and aseptic necrosis.

Since the work of Axhausen in 1920, a number of workers have tried to produce these conditions experimentally in animals by replacing excised fragments of the femoral head, but have failed. It is not known whether these experiments were carried out on adult animals or young animals.

The author performed these experiments in order to ascertain whether the etiology of these conditions is (1) mechanical-traumatic or (2) spontaneous aseptic necrosis.

In 1930, Nagura was able to experimentally produce osteochondritis of the femoral head of growing squirrels by causing an incomplete fracture of the articulating cartilage. By means of a carefully measured blow to the femoral head incomplete fractures of the cartilage, or of cartilage and subchondral plate or cartilage subchondral plate and part of the metaphysis were produced. Depending upon the location of this blow Perthes' disease, osteochondritis dissecans, or coxa vara was produced.

The author used repeated measured traumas to localized areas of the epiphysis or metaphysis. By directing the blows on the epiphysis, osteochondritis was seen after a lapse of 5 months. Following blows on the medial corner of adjoining portions of the epiphysis and metaphysis, coxa vara developed after about 1 year.

It is possible that, in humans, repeated traumas to one area of the proximal end of the femur is the cause of these conditions and the insidious development of symptoms, however this theory does not answer all questions, i.e. why these conditions occur in certain families and in certain parts of the world, the hereditary factors and the role of endocrine dysfunctions (hypothyroidism).

Degenerative arthritis has a similar sequence of symptoms and end-results, as observed in Perthes' disease, except that it occurs in older people.

GEORGE I. REINE, M.D.

**Evolution of Mould Arthroplasty of the Hip Joint.** M. N. SERRA-PETERSEN. *J Bone Surg* 1945, 30B: 59.

The present article is in substance the fourth Moynihan Lecture delivered by this author (May 1947) at the University of Leeds.

The article is accompanied by many excellent illustrations depicting the older hip joint approaches with their pitfalls and the Smith Petersen procedure with its advantages.

In 1923 the author constructed and employed the first glass mould arthroplasty cup. To his amazement the mould broke on weight bearing. A specimen of the femoral head, removed 25 months after operation revealed regeneration of hyaline cartilage the finding of which justified his continued interest in the cup arthroplasty. It was not until 1937 that his dentist, Dr Cooke suggested to him the use of a vitallium mould. Since then more than 500 hips have been treated with a cup arthroplasty. In 80 patients the condition was bilateral.

The indications were as follows: (1) malum coxae senilis 90 cases (2) rheumatoid arthritis 120 cases (3) complication of fractured hips such as nonunion, aseptic necrosis and dead heads 50 cases (4) old septic hips, 32 cases and (5) congenital dislocations (50 hips). In the latter group 10 cases were bilateral.

Fifty-three of the 500 hips operated upon have been subjected to an additional revised arthroplasty. These secondary operations involved the earlier cases, in which an error in technique and judgment had been made. Other reasons for secondary operation were calcification of the rectus tendon at the inferior iliac spine shallow acetabulum decreased

range of motion operative sepsis and intrapelvic protrusion of the acetabulum.

No deaths occurred in this large series of cases. Septic complications at the site of operation developed in 20 cases. SAMUEL L. GOVERNALE, M.D.

**Pseudarthrosis in the Lumbosacral Spine.** MATHER, CLEVELAND, DAVID M. BOSWORTH, and FREDERICK R. THOMPSON. *J Bone Surg.* 1948 30-A 303.

The study of 647 fusion procedures on the lumbosacral spine carried out on 594 patients presented the problem of pseudarthrosis in 119 patients, or 20 per cent. The mortality and complications were of minor importance in these patients, all of which were operated upon by the three authors personally working in six different hospitals.

At 161 of the 1320 spinal intervals bridged pseudarthrosis occurred. The incidence of pseudarthrosis increased as the area of fusion was lengthened. Of all the patients in whom pseudarthrosis developed 41.4 per cent were nonetheless relieved of their pre-operative symptoms. In spite of solid fusion a number of patients were not relieved of their pain, especially those in whom only one or two intervals were bridged, or those whose lumbosacral junction was not crossed.

Flat roentgenograms are not adequate to show accurately whether or not pseudarthrosis is present.

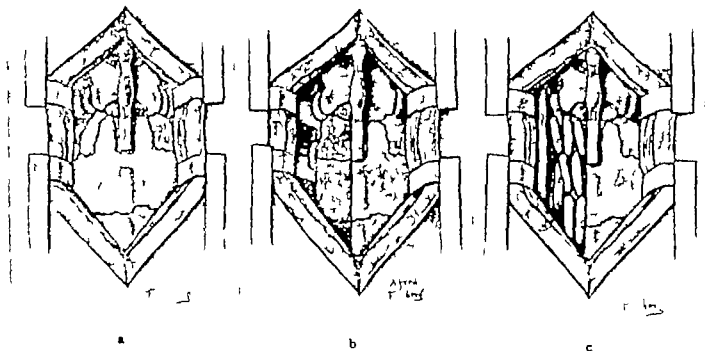


Fig. 1 (Cleveland et al.) a, Two types of pseudarthrosis are shown, the usual transverse type and the type occurring at the end of a cloister graft. b, Repair of such pseudarthrosis is carried out on one side only. Transverse processes and articular facets are exposed, and the site of previous fusion is denuded on its posterior surface only. c, A wide iliac strip is set vertically on the transverse processes

outside the articular facets and in contact with them. Strip grafts of ilium are then placed over the dorsum of the previous fusion on one side, in the angle between the fusion and the vertically placed graft. The remainder of the previous fusion on the opposite side is not even exposed, being shown in the illustration only for clarity. It is left alone for such support as the bony masses already provide.

Biplane bending films, superimposed, increased the accuracy of diagnosis of pseudarthrosis in this series from 11.8 to 50 per cent. A careful analysis of the relation of pseudarthrosis to the lesion for which arthrodesis was attempted, and of the various operative procedures used, indicates that least difficulty is encountered when only the lumbosacral interval is bridged. The use of additional re-enforcing bone at the fusion site reduces the incidence of failure of arthrodesis.

A mortality of only 1 per cent occurred in this series. Only 35 patients of the 119 in whom pseudarthrosis occurred returned to the authors for repair. The repair is appreciably more difficult than the original operation. A new type of repair is described and illustrated which avoids many of the factors of previous failure.

FRANCIS E. BRIDGES, M.D.

**Plantar Digital Neuritis; Morton's Metatarsalgia.**  
K. I. NISSEK. *J Bone Surg* 94B, 30B 84.

The neuralgic pain felt at the fourth metatarsophalangeal joint is known as a Morton's toe. Anatomically the innervation to the third and fourth digits is a dual one, namely the internal plantar nerve and a small communicating branch of the external plantar nerve. The latter may be inconstant. As a rule the above nerves are protected from trauma by being surrounded by plantar fascia and fat. The blood supply comes from the deep plantar arch and is adequate.

As far back as 1893 Hoadley resected a small neuroma of the external plantar nerve to the fourth toe and obtained a prompt and perfect cure. It was not until 1910 when Betts reported a series of cases of fibrosis of the epineurium of the internal plantar nerve to the third and fourth toes, that Sir Robert Jones and others recognized the Morton's phenomenon as a neurofibroma of the interdigital nerves to the second, third and fourth toes.

The author presents 37 interesting cases of metatarsalgia. In these patients (31 women and 5 men) the pain was generally felt between the third and fourth toes.

At operation, the nerve was exposed by a longitudinal plantar incision. Usually the nerve can be sought where it crosses the transverse ligament. If it is adherent to the latter structure and is obviously thickened, resection yields complete abolishment of the characteristic manifestations.

Histological examination of the specimen is predominantly an ischemic one.

Photomicrographic studies of the fibrous bulk reveal an increased epineurial connective tissue proliferation, degeneration of the nerve fibers, and degenerative changes of the digital artery with disruption of the arterial wall and incomplete recanalization thrombosis, and similar changes to the intra neural vessels.

The coexistence of the thromboarteritis and the neurofibroma is not clear to the author.

SAMUEL L. GOVERNALL, M.D.

**Tuberculosis of the Cuboid (Tuberculosis del cuboide)**  
C. DI MAIO. *Reforma med.*, 94B, 6: 13.

The author describes a rare case of tuberculosis of the cuboid bone in the foot of a woman 33 years of age. For a period of 4 years the patient had complained of pain on the dorsum of the foot, with nocturnal exacerbations. A month after the onset of pain she noted edema of the lateral surface of the foot, which was aggravated on standing. Hot compresses gave temporary relief however, a month later a soft tumorous swelling the size of a walnut appeared. This finally broke down into an ulceration, with drainage of a purulent liquid. A fistulous tract resulted. In spite of treatment over a period of 3 years with a fenestrated cast, calcium iodide, and diathermy the subjective and objective symptoms remained the same. Seropurulent material exuded from the ulcer. Its margin was cyanotic in color and was undermined for a distance of 3 cm. Inguinal lymph glands were not palpable. Active and passive movement of the ankle joint was impossible.

Röntgen-ray examination of the foot revealed an accentuated deossification of all the bony components of the foot and the distal part of the leg. An irregular zone of rarefaction was present in the center of the cuboid.

The cuboid was surgically removed in pieces as it broke in the process of removal.

Gross examination of the fragments revealed a cortex diminished in thickness, with loss of the normal architecture while the spongy portion had a grayish color.

Histological examination revealed granulation tissue with numerous typical and atypical areas and also a zone of increased calcified osseous tissue.

The condition in this patient had to be differentiated from syphilis, chronic osteomyelitis, neoplasm, and actinomycosis.

In infancy these patients should receive good general care, heliotherapy and orthopedic treatment. In adolescence and thereafter a cuboidectomy should be done if there is no response to medical management.

ARTHUR F. CIPOLLA, M.D.

**SURGERY OF THE BONES, JOINTS,  
MUSCLES, TENDONS, ETC.**

**Obturator Nerve Avulsion in the Treatment of Painful Hip Joints.** EMANUEL B. KAPLAN. *Surg Clin. N. America*, 94B, 45: 473.

Nerve endings and their behavior in articular and periarticular tissues have been studied by several investigators without establishing any conclusions.

Gross anatomical descriptions of the nerve supply to the hip seem to have been originally based on rather limited dissections, and repeated by one author after another. This anatomical background for the problems of painful hips leaves many clinical observations without adequate explanation and therefore without rational therapy.

The obturator nerve has a large articular branch from its posterior division, but various other fine

branches are known to exist though they are difficult to trace. Less recognized is the proximity of the femoral nerve to the head and neck of the femur. Compression of the femoral nerve can give pain on the inner aspect of the knee through the saphenous nerve. Of the many surgical procedures devised for the relief of pain about the hip, avulsion of the articular branches of the obturator nerve is attended with minimal risk, so suitable especially for older debilitated patients.

The author and assistants studied 52 specially dissected hip joints in cadavers and concluded that the anterior capsule is largely supplied from the obturator nerve. On this basis, obturator avulsion was done on 54 patients at the Hospital for Joint Diseases in New York. A preliminary test injection of novocain in the area of the obturator nerve was done on each patient. Relief of pain after injection was considered an indication for the surgical procedure. The femoral triangle approach was used and found simple and rapid in this group. Relief of pain was noted as soon as the patient recovered from anesthesia. The patients were out of bed in from 1 to 2 days. No sensory disturbance was noted in the medial thigh areas, and there was minimal interference with adduction. General improvement was noted in 67 per cent of the cases and good results (pain diminished so that the patient could walk) in almost one-third of the cases.

FRANCES E. BRIDGEMAN, M.D.

**The Results of Periarticular Arthrodesis of the Knee in Tuberculosis of the Putti Method (Sui risultati dell'artrodosi para articolare secondo Putti nella del ginocchio)** S. COLOMBANI, *Chir. org. mod.* 1947 51 1

Putti in 1933, published his results in 8 cases of tuberculosis of the knee in which he used fusion according to his method. Only 3 of these cases were followed up to a complete cure at the time of his original publication. Putti believed that the only certain cure for tuberculosis of the knee was solid ankylosis. He thought that an exarticulation fusion was easier to do and did not sacrifice any leg length. With his method he made use of a tibial graft running from the front of the tibia into the intercondylar area of the femur. In this manner the tuberculous area was not disturbed and toxic phenomena were minimal.

The author presents his results in 16 cases of tuberculosis of the knee treated by this method in the period from November 10, 1934 to August 19, 1943. Only the final results are presented in this article. Fifteen cases were treated successfully.

Postoperatively all patients were immobilized in a plaster cast, in some the pelvis, leg and foot were included while in others circular casts extending from the groin to the toes were applied. The period of immobilization was from 3 to 12 months.

The article is illustrated with roentgenograms taken before and after surgery.

CARLO SCUDERI, M.D.

## FRACTURES AND DISLOCATIONS

**Contribution to the Biochemical Study of Bone and Callus in Fractures (Contribución al estudio bioquímico del hueso y del callo de fractura)** E. CAVAYE, HAZEN and E. RIBEROUT, VALDÉS SANTURIO, *Cirugía locomotora* 1948 5 2

Variations were observed in the chemical composition of the callus in fractures treated with simple immobilization and in fractures treated by the method of Kuntscher.

Dogs were used in these experiments. A fracture through the femur was produced with a Phelps Gocht osteoclast and a Kuntscher nail was introduced through the trochanter. In the control series a transverse fracture was produced and the fragments were permitted to remain in good position. The dogs were then sacrificed on the twelfth, twentieth, thirtieth, fortieth, fiftieth and sixtieth days.

In order to study the mineral composition of the callus and bone at the site of the fracture, all soft parts were removed. The callus was then reduced to ashes in an electric oven. Dilute hydrochloric acid was used to dissolve these ashes and the resulting solution was used to test the various minerals.

Calcium composition was determined by the addition of ammonium oxalate which formed a precipitate of calcium oxalate. Inorganic phosphorus was determined by the Bell Doisy technique. Anhydrous carbonate by the van Slyke method. Total nitrogen by the method of Kjeldahl and phosphatase by the method of Fiske and Subbarow.

In observing the phosphorus/nitrogen ratio, the author noted a progressive increase in mineralization during the first 12 days (11) and a value of 1.3 after a period of 60 days. The general reaction was the same in fractures in which pins had been used and in those which had been treated without the use of pins. The maximum demineralization was effected in 45 days followed by gradual recuperation.

Demineralization phenomena in the pinned limb were accentuated due to the presence of the steel stem but were only a little greater than in the unpinned one.

No appreciable difference was observed in the process of mineralization of the callus or the phosphatase activity. These facts clearly show that steel pins do not hinder mineralization of the callus.

ARTHUR F. CIPOLLA, M.D.

**Habitual Dislocation of the Shoulder** H. OSWOND-CLARKE, *J. Bone Surg.* 1948 30B 19

Platt devised his operation in 1925 after having performed several Bankart operations. His operation consisted of sewing the distal portion of the divided subscapularis tendon to the cartilaginous remains of the glenoid margin, thus providing a primary barrier to redislocation of the humeral head as well as a check-strap to prevent complete external rotation. Then the proximal end of the divided tendon was overlapped and stitched to the anterior capsule, thus strengthening and shortening it. A similar procedure

was developed independently by the late Doctor Putti and his associates.

The technique as described by Osmond-Clarke is as follows:

An anterior approach is used, the skin wound curving inwards along the outer one-third of the clavicle then extending downwards for about 6 inches. It is important that the incision should skirt the medial edge of the tip of the coracoid process. The groove between the deltoid and the pectoralis major muscle is widely opened. The cephalic vein usually requires ligation. The next step is to expose the coracoid process and free the conjoined tendon of the coracobrachialis and the short head of the biceps. To do this adequately it is wise to divide the upper inch of the margin of the pectoralis major tendon, and particularly the attenuated expansion of it that runs upwards under the deltoid to reach the capsule of the joint. The tendon is freed on all aspects and divided close to the coracoid process, leaving a sufficient stump to facilitate subsequent repair. It is retracted downward by means of a stitch, but must not be pulled too vigorously or freed too extensively or the nerve supply may be damaged. The next step is to divide the tendon of the subscapularis muscle, which is done by first passing a blunt instrument beneath the tendon from above to below and dividing it one inch from its insertion. The capsule is opened at this point also. The glenoid rim is inspected from within the joint. The distal stump of the subscapularis tendon is then attached to the most convenient soft tissue structure along the anterior rim of the glenoid cavity i.e. the labrum or the deep surface of the stripped capsule and subscapularis muscle. The anterior surface of the neck of the scapula should be roughened to insure that the sutured "tendocapsule" will adhere to it. The medial portion of the capsule is drawn outwards so as to overlap the sutured tendon of the subscapularis, and the subscapularis muscle is then drawn outward and sutured to the scarified tissue in the region of the bicipital groove. This overlapping causes shortening of the muscle and should not be overdone. The arm should readily rotate outward to the neutral position.

The after treatment consists of the employment of a Velpeau type bandage for a period of 3 to 4 weeks, followed by exercises to redevelop muscle power and movement.

The author's results have been good, but no detailed analysis of his cases is presented. The article is accompanied by 9 excellent full color illustrations of the operative technique.

NEWTON C. MEAD, M.D.

Recurring Dislocation of the Shoulder W. E. GALLIE and A. B. LE MESURIER, *J Bone Surg* 94B, 30B, p.

This article appears as one of 6 articles on the subject of recurring dislocation of the shoulder and was published as a résumé of a symposium at the Annual Meeting of the British Orthopaedic Association. The clinical features, operative findings and detailed fol-

low-up results in 641 recurrent anterior dislocations of the shoulder are reported.

The authors devised a fascial transplant for the reconstruction of an anterior ligament of the shoulder in 1936 and have used it in 175 consecutive cases, with only 7 known recurrences.

In a study of nearly 300 cases, the authors have made definite observations and have fabricated a typical history. They subscribe to the thesis of Bankhart that recurrent dislocation is secondary to failure of healing of avulsion of the anterior glenoid labrum and joint capsule of the neck of the scapula. In conjunction with their study Professor J. C. B. Grant examined the shoulder joints of a large number of cadavers, and observed that sometimes the labrum is not attached to bone throughout, but only at intervals, and that a hook can be slipped under it, thus lifting it from the bone. Anomalies of this type may account for the ease with which the head of the humerus sometimes slips over the glenoid rim.

Regardless of the inciting cause, recurrence is the result of the loss of the normal obstruction to forward displacement of the head. The indications for treatment are clear i.e. the repair of damaged ligaments or the construction of new ones.

The operation is performed through an anterior shoulder incision separating the deltoid and pectoralis major in the groove, the short head of the biceps and the coracobrachialis muscles are retracted inward, the lower border of the subscapularis is identified and retracted upward, the areolar tissue over the capsule is bluntly dissected and the anterior brim of the glenoid palpated about one-half inch above its lower border a drill is passed backward upward, and slightly outward through the head of the scapula, the long drill is passed through the soft tissue posteriorly until it may be palpated under the skin, a short incision is made and a strip of fascia lata 1 inch wide and 10 inches long is guided back through the hole and drawn from posterior to anterior the trailing end of the fascia is knotted and oversewn with silk to prevent the knot from untying, the fascial strip is pulled through the scapula until the knot is felt to engage the posterior surface of the scapula, a tunnel is made in the head of the humerus and the strip passed through and, lastly, guided through hole in the coracoid process where it is firmly attached. The new ligament is drawn sufficiently taut to limit external rotation of the shoulder about 35 degrees. Ultimately this limitation nearly disappears.

Postoperatively a sling is worn for one month for the prevention of external rotation and abduction. The patient then begins exercises and regains almost full range of motion in from 3 to 4 weeks.

Results have been gratifying and all patients have returned to their ordinary work. Eighty patients, in whom the condition occurred in the Armed Forces, were returned to duty and ultimately demobilized without pensionable disability.

Of the 7 recurrences, 5 followed severe violence that might have dislocated normal shoulder. Five

other recurrences were attributed to a technical defect in the operation and should not occur again. The statement is made that if the new ligament is attached to the neck of the scapula a little below the middle of the anterior edge of the glenoid the head of the humerus cannot slip forward.

KENETH H. SPOONER, M.D.

**A Review of 180 Cases of Recurrent Dislocation of the Shoulder** J. CRAWFORD ADAMS. *J. Bone Surg.* 1943, 30B 26

The present article is based on 180 cases and 159 operations. The author discusses the pathology, the mechanism of production and the operative treatment of recurrent or habitual shoulder dislocation.

Bankart believes the pathology is always the same, namely detachment of the glenoid labrum from the bone margin of the glenoid cavity in its anterior aspect. He does not think that bone changes in the humeral head are important.

Bone lesions occur more frequently than is generally supposed for they may exist without discovery by routine roentgen examination or even surgery. Roentgenographic examination with the arm sharply rotated internally will show the defect in the upper and outer margin of the humeral head or else a dense line of condensation extending down from the top of the humeral head parallel with the shaft representing compaction of the spongy bone. These lesions were present in almost the same percentage (82%) as the labrum detachment, which was present in 87 per cent of cases adequately examined. At surgery it was found to be present in all cases in which the labrum was not detached. This can produce dislocation because when the arm is externally rotated and abducted the flattened portion is in contact with the anterior rim of the glenoid and it can easily slip over. The mechanism of production as found in this series, varied as follows:

- 1 A fall on the abducted arm (very frequent)
- 2 A direct blow from behind acting on the head of the humerus (relatively infrequent)
- 3 Hyperextension of the abducted arm (infrequent)
- 4 Excessive external rotation in abduction straining the anterior capsule and tearing or stripping it from the scapular neck (infrequent)
- 5 Inferior dislocation by hyperabduction (rare)

Operative treatment. The Nicola operation was used early but has been generally discarded. The Putti Platt and Bankart operations are good, have proved reliable and have gradually replaced it. Thirty-six per cent of the Nicola procedures were followed by redislocation after an average period of 22 months. Mobility of the shoulder after this operation is very good, often normal and may be the reason for some of the redislocations. Pain followed the Nicola procedure in 30 per cent of the patients.

The Bankart operation gives stability and pain free function but does limit external rotation. In cases in which the glenoid labrum is found to be intact some other operation must be performed.

The Putti Platt operation in which the subscapularis tendon is attached to the soft tissues anterior to the scapular neck and the tendon is shortened by overlapping has been satisfactory as it gives stability and is painless. External rotation has been definitely limited in most cases. When redislocation has occurred it has been in patients in whom external rotation had been completely regained which suggests that the operation was incorrectly done.

Operative treatment aims at correcting or nullifying the two underlying lesions. The labral detachment is corrected by reattachment or by an anterior buttress of fibrous or bony tissue. The humeral head defects are nullified by prevention of external rotation which allows the flattened aspect of the bone to slide over the glenoid rim.

NEWTON C. MEAD, M.D.

**Recurrent Dislocation of the Shoulder** A. L. EYRE. *Brook. J. Bone Surg.*, 1948 30B 39

In 17 operations for recurrent dislocation of the shoulder by the Bankart approach it was revealed that the cause of the dislocations was (1) some lesion of the anterior surface of the head of the humerus (2) a groove in the posterior surface of the head of the humerus, which made the dislocation possible with less anterior displacement or (3) both.

In nearly half (8) of the cases both causes were present. Bankart's lesion (labral detachment) was responsible alone in only 5 cases. The humeral groove alone was the cause in 3 and 1 case was due to partial detachment of the subscapularis distally at the lesser tuberosity.

To repair Bankart's lesion the author uses Bankart's operation but he has modified the technique of suturing the detached labrum to the glenoid. He makes two grooves in the anterior aspect of the scapular neck leaving a stout bridge of cortical bone coming right up to the lip of the glenoid between them. A suture is passed under this bridge and holds the labrum, perosteum and capsule firmly down in place. He uses a sucker to keep the wound dry, a special cutting hook to pass the suture and methods of retraction to make this procedure practicable.

When a humeral groove is present in addition to a lesion of the anterior support of the head of the humerus the same procedure is followed unless the dislocation is considered primarily due to the humeral groove. In the latter case a bone graft comprising the entire thickness of the iliac crest has been fixed with a screw to the anterior surface of the scapular neck. Careful anatomical closure is important.

After treatment consists in keeping the arm at the side from 4 to 6 weeks. This is followed by exercises to regain movement.

NEWTON C. MEAD, M.D.

**Symposium on Recurrent Dislocation of the Shoulder** A. BERNARD PAIN, A. S. BLUNDELL, BANKART, P. NEWMAN, H. OSWOLD-CLARKE, and C. PERKINS. *J. Bone Surg.*, 1943 30B 46.

A. BERNARD PAIN (Leeds) reviewed 45 operations for this lesion. The Henderson fascial sling was used



in 13 cases, in 9 of which this method of treatment failed. He believes that fascial-sling operations are without value and that tendon slings are better but are not reliable. The Nicola operation was done in 12 cases, with failure in one-third of them. The anterior bone block operation was done in 4 cases. There were no recurrences up to the time of this symposium. Other procedures have been carried out, but in too small a number of cases for proper evaluation.

**A. S. BLUNDELL BANKART** After 30 years experience with his own operation, this discussant states there has been no recurrence of the condition, nor serious interference with motion afterwards. There is a constant anatomical lesion consisting of a tearing of the fibrocartilage or the capsule from the bone, and the obvious thing to do is to put it back again. The bone must be prepared (freshened) for this in order that the tissue will unite with it. No permanent internal fixation is necessary because the tissues will unite in 6 weeks or less. A dental drill is used to place a single mattress suture in the glenoid and this solves the only difficult part of the operation. No shortening or tying down of the subscapularis is necessary or desirable.

The lesion causing recurrent dislocation is not always a detachment of the labrum, but often the capsule is torn from an intact labrum. Bankart's operation takes care of either type of pathology as the capsule is divided at the glenoid margin and the distal cut edge is fastened to the denuded bone. This eliminates "laxity" and prevents redislocation.

The frequent grooves of the humeral head are the result of, and not the cause of, the dislocation. If the capsule is firmly attached to the glenoid dislocation cannot occur regardless of the groove.

**P. NEWMAN** The Bankart suture, which is put through the joint so that the humeral head can be levered away, enables one to drill the holes in the anterior glenoid rim easily.

**OSWOLD-CLARKE** Detachments of the labrum are not present in 10 per cent to 15 per cent of the cases, and an operation should be devised for these. The Bankart operation is difficult to do, and an easier method of repair which gives a good anterior block and at the same time limits external rotation so that the bone defect in the head of the humerus can not engage the glenoid margin seems to be the answer to this problem.

NEWTON C. MEAD, M.D.

**Note on Recurrent Dislocation of Shoulder Joint.**  
REGINALD W. THOM-JONES. *J Bone Surg* 1948, 30B 49.

Basing his opinion on 71 operations for recurrent dislocation of the shoulder this author believes that the only reliable methods of repair are those which correct the defect of the glenoid labrum and reef the anterior capsle of the joint (Bankart, Putti, Platt). Recurrence followed in only one of 53 such operations and this particular shoulder was repaired through a superior approach, while all of the others were repaired through an anterior exposure.

The technique of the superior approach is described in detail. It involves a saucer-cut incision centered on the acromioclavicular joint with osteotomy of the base of the acromion. The latter is reflected outward together with the clavicular origin of the deltoid and the musculotendinous cuff of the shoulder is incised in the line of its fibers. It provides a very good exposure for the study and repair of the glenoid lesions, often considered responsible for the dislocations. This is demonstrated by three excellent colored photographs. The technique described does not result in fibrosis and shortening or 'tying down' of the subscapularis tendon and the limitation of external rotation following surgery. The one recurrence in this series is believed to be due to this defect of the superior approach.

The author concludes that the most important virtue of Bankart's procedure is the fact that the anterior approach results in fibrosis and shortening of the anterior structures and limitation of external rotation. In cases in which there is a humeral head defect it is believed that repair of the glenoid labral defect alone is not sufficient.

NEWTON C. MEAD, M.D.

**Bone Block for Recurrent Dislocation of Shoulder.**  
I. PALMER and A. WIDMER. *J Bone Surg* 1948, 30B 53.

The authors describe the Hybinette Eden operation performed in 90 cases of recurrent dislocation of the shoulder. Sixty patients in this series (8 women and 52 men) have been selected for detailed study. The article is accompanied by roentgenograms, a diagram depicting the mechanism of the dislocation, case reports, and a diagrammatic sketch of the surgical technique.

The operative technique is simple. A 3 inch incision is made between the deltoid and the pectoralis major muscles. The subscapularis tendon is located and cut  $\frac{3}{4}$  of an inch from its insertion and, by rotating the humeral head outward, the medial glenoid lip is visualized. With the aid of a rasp, a subperiosteal pocket is made for the reception of an iliac bone graft and the graft is placed adjacent to the medial portion of the glenoid lip to prevent recurrent dislocation of the humeral head.

In 27 cases, the pathological findings at operation were those of typical detachment of the labrum from the anterior glenoid rim. In 22 cases, the labrum was ruptured, with frayed flaps of the lower anterior part of the rim. In 5 cases and 4 cases respectively the changes were minimal or there were no changes at all and in 1 cases there was detachment of the labrum with capsular rupture of the whole anterior aspect of the rim.

The authors follow-up studies revealed that 53 of the 60 patients had obtained excellent results. Normal range of motion of the shoulder was observed in 48 cases and from 10 to 20 degrees restriction of motion was observed in 11 cases. Four patients (6.7%) experienced redislocation.

SAMUEL L. GOFERDALE, M.D.

Fig. 1 (Moore.) Illustrates the preparation of the head the light test, and the fitting of the head on the femur

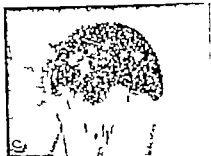
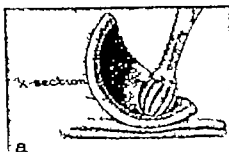


Fig. 2 Shows the cartilaginous cup properly placed on the end of the femur and inserted within the acetabulum. The fragment of the trochanter is attached to the femur with a Vitallium screw. (Note that the shaft of the femur is in wide abduction.)

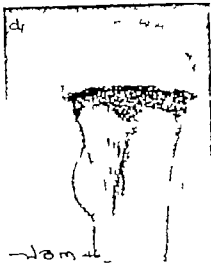


Fig. 1

#### Cartilaginous Cup Arthroplasty in Ununited Fractures of the Neck of the Femur JOHN ROYAL MOORE. *J Bone Surg* 1948, 30-A 313.

Since the use of internal fixation for femoral neck fractures, the incidence of nonunion has been greatly reduced. Because of the trauma of the fixation materials however, there is often gross distortion or defect of the ununited fragments. Aseptic necrosis of the femoral head continues to occur with some frequency.

Ununited fractures of the femoral neck may result as follows:

1. Nonunion with a viable head.
2. Nonunion with a viable head and complete or nearly complete absorption of one or both neck fragments.
3. Nonunion with absorption of the neck fragments and a devitalized head.

The surgical procedures best suited for use in all of these conditions are described and a modification of the Brackett operation devised by the writer in 1938 is presented. The meticulous technique of this procedure involves reaming out the femoral head until only a translucent cartilage cap remains. The femoral fragment is shaped to fit snugly into the cap and the leg maintained in wide abduction by a one and a half hip spica. Careful postoperative change of position and graduated active joint motion is carried out until weight bearing is permitted at the end of 10 weeks.

No operative deaths occurred, but from a patient dying 9 years after this procedure sections of the joint surface were obtained. Viable articular car-

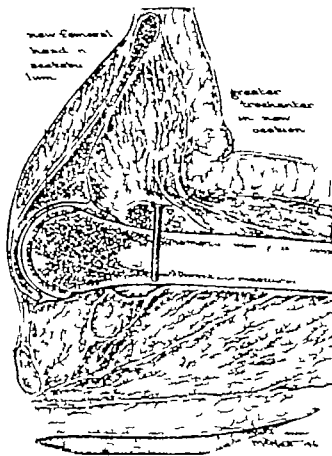


Fig. 3

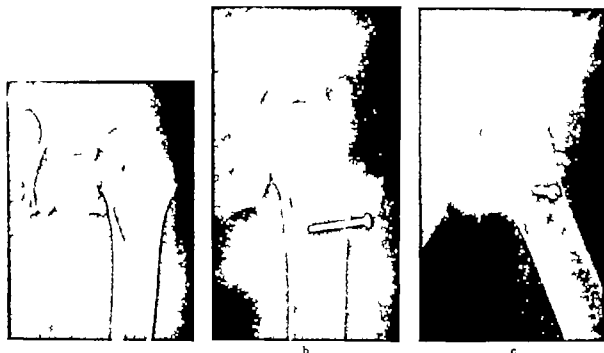


Fig. 3. a, Ununited fracture of the neck of the femur (January 24, 1946) b and c, Anteroposterior and lateral views of cartilaginous cup after 3 months (May 5, 1947)

tilage was reported from microscopic studies of sections of the femoral cap. Grossly the femoral cap could not be manually freed from the femoral stump in a specimen secured from a patient who died 3 weeks postoperatively on account of pulmonary embolism.

Of 11 cases which have been followed up for from 1 to 9 years, 9 showed excellent results. The average leg shortening was 3 cm. or less, and the range of motion quite satisfactory.

FRANCIS E. BRIDGEMAN, M.D.

**Pathologic Anatomy and Treatment of Fractures of the Lateral Condyle of the Tibia** (*Anatomie pathologique et traitement des fractures du plateau tibial externe*) JEAN GOSSET *Mém. Acad. chir. Par.* 1947 73 670.

Seven patients with fracture of the external tuberosity of the tibia were treated by immediate open operation with elevation of the depressed central fragment (made up, as a rule, of that area of the joint surface which is not covered by the lateral meniscus) reapposition of the medially concave marginal fragment, and fixation of the whole, by a bolt passing through the fragments and held at each end by loosely applied disclike end pieces. The material comprised 4 women of 36, 60, 38, and 43 years of age, respectively; the remaining 3 patients were men of 34, 36 and 60 years of age, respectively.

Following the operation the limb is immobilized for 8 days, then the patient begins the mobilizing exercises himself. At first he practices static con-

tractions of the quadriceps and 30 days later he begins passive flexion exercises of the joint. In only one case was it necessary to break up an obstruction to flexion (under anesthesia) in order to obtain flexion of the operated knee joint of more than 90 degrees. In all of the other patients flexion was attained, and the patient was able to walk without limp could stand easily, and even hop on the operative limb.

In the subsequent discussion MERLE D'AUBIGNÉ, who has been advocating late operation in the form of lateral osteotomy of the tibia below the attachment of the quadriceps tendon with insertion of a wedge-shaped bone implant to straighten up the joint surfaces after the fracture has been allowed to heal without correction other than orthopedic procedures, criticizes the author's method of excising the meniscus in order to get more room to get at the fracture and exhibits pictures and roentgenograms of a number of patients in whom, he maintains, Gosset's method could not be used.

GOSSET in his reply does not defend himself against the criticism aimed at his removal of the meniscus however he does defend his method of early operation and bolting of the fragments and maintains that such cases as were shown by d'Aubigné are the exception, as all 7 of his series of unselected patients presented perfect functional results and only one patient, who had a comminuted fracture of both condyles of the tibia and should never have been operated upon could be classed as having an unsatisfactory result.

JOHN W. BRIDGEMAN, M.D.

**The Treatment of Fractures of the Malleoli. An Experimental Study (Traitement des fractures de malleoles)** HUBERT DE RUYSSER. *Helv. chir. acta* 1948, 15, 24.

It is remarkable how frequently nonunion of fractures of the medial malleoli is seen. In most instances it is due to incomplete reduction of the fractures. In these experiments an attempt was made to find the best possible position of the foot in the reduction of fractures of the malleoli. Three series of experiments on cadavers were carried out. In the first group the malleolar region was carefully dissected and, by means of a chisel and mallet, a fracture was created in a manner most frequently seen clinically. In some cadavers, all muscles about the foot and lower leg were cut.

It was concluded that muscle power and valgus and varus positions of the foot had little influence on the position of the fractures. As a rule plantar flexion was favorable for alignment of fractures of the lateral malleolus. dorsiflexion of the foot was favorable for medial malleolar fractures.

In the second series of experiments, a fracture was created by having the chisel cut through the undissected malleoli. The findings corresponded in general with the results obtained in the first series.

In the third series of experiments, a heavy clamp was utilized to produce the fracture. In all cases, the force necessary to create a fracture of the malleoli also ruptured the surrounding skin and soft parts. It was thus impossible to create conditions which would resemble those found in living human beings. In the final analysis, the absence of the fracture hematoma, the different ligamentous injuries in vivo and irregular fracture lines usually found in living human beings were taken into consideration.

It was found that complete reduction of the fracture was a prerequisite for good healing. Therefore even if extreme equinus or calcaneus position of the foot is necessary for good alignment of the fracture line it should be used. The same applies after internal fixation (screw) of fractures of the malleoli.

GEORGE I. REISS, M. D.

## ORTHOPEDICS IN GENERAL

**Orthopedic Appliances in the Rehabilitation of Patients with Spinal Cord Injuries.** DONALD S. BICKERS. *N. England J. M.*, 1948, 338, 545.

The use of orthopedic appliances has helped greatly in the rehabilitation of patients with spinal cord injuries. Proper bracing is the cornerstone on which the ambulation program is built.

The spasm of an even, moderately well developed mass reflex, particularly in injuries of the thoracic and cervical cord, renders this goal unattainable. The sudden unpredictable stretch reflexes cause flexion or extension of the lower extremities and trunk, with precipitate loss of balance. The result is either a fall or a rescue by the instructor which offers a psychologic and mechanical hindrance to ambulation progress. Decubitus ulcers an ever

present threat in paraplegic patients, frequently result when braces are forced on a markedly spastic subject.

Evaluation of numerous agents and procedures for the relief of spasm, employed in the treatment of 200 patients during the past year, indicate that the treatment of choice is the anterior rhizotomy described by Munro. With proper indications complete rhizotomy is carried out on complete cord lesions, and differential rhizotomy is done on partial cord lesions.

The function of the brace is not the support of body weight but the maintenance of normal postural relations through splinting action. In effect, the muscle groups responsible for maintaining the body in an erect, stable position are replaced by external mechanical supports with maximum retention of normal joint function.

In patients with partial lesions of the conus and cauda secondary to penetrating wounds at or below the first lumbar vertebra, the function of the brace is to substitute a compensatory force for the lost dorsiflexors of the foot and, if necessary to stabilize the ankle. Such patients are adequately supported with the wire drop-foot brace, since no lateral stabilization of the ankle is required, otherwise this is best done with the double upright drop-foot brace which provides good bilateral support of the ankle joint and positive spring drop-foot correction.

The ability to maintain the legs in extension and consequently to maintain the body in erect posture is directly dependent upon the integrity of the quadriceps femoris muscle. These lesions occur predominantly in the lumbar cord segments but may be due to severe or complete transections of the cauda equina at or below the level of the third lumbar vertebra.

Injuries from the third lumbar segment or cauda equina, or both, that are so complete as to deprive the patient of the functions of supporting the body weight on the lower extremities will in some cases require the pelvic band extension. The additional factor involved is the loss of part or all of the function of the internal and external rotators of the thigh.

The hip joint of the brace must be placed at the proper level to obtain maximum function of that joint. Its position should be opposite the superior border of the greater trochanter, which is the point of exit of the transverse axis of the hip joint. When the joint is too high there is downward traction on the pelvic band as well as undue pressure on the anterior aspect of the thigh by the thigh band when the patient is in the sitting position. If the joint is placed too low there is an upward thrust on the pelvic band and pressure on the posterior aspect of the thigh. The pelvic band should fall midway between the crest of the ilium and the greater trochanter to avoid pressure over the bony prominences with possible decubitus ulcer formation.

Long leg braces with back brace attachments are limited to the highest levels of injury—that is generally those above the third lumbar vertebra. Its



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Long leg braces with back brace attachments are limited to the highest levels of injury—that is generally those above the third lumbar vertebra. Its

distinguishing feature is lateral hip stabilization by functional replacement of muscle groups controlling the actions of the pelvis and lumbar spine.

Patients requiring only drop-foot braces approach most nearly the normal gait. They may use ultimately either one or two canes and walk almost normally except that they tend to proceed on a rather wide base with steppage gait. The type of gait to be employed by patients with long leg braces will depend on the degree of function remaining in the thigh flexors. Should the thigh flexors be adequate to advance the legs even though not strong enough to support the patient's body weight, either the four-point or the more rapid two-point crutch gait is feasible. In either case the patient should also be taught the swing through, which is the most rapid of all gaits and may be required in situations in which speed is desirable as in crossing streets with traffic lights. Patients with pelvic band extension will not usually exhibit enough function to allow the two-point and four-point gaits and consequently must be taught the swing through with the preliminary temporary swing to gait. For patients requiring back braces, the only practicable gait for distance walking is the swing through, which is taught to all patients with the exception of those with lesions situated above the second thoracic segment that are so

severe as to cause gross impairment of arm function.  
C. FRED GORDON, M.D.

**Autotransplantation of Joint Capsule; an Attempt to Desensitize Patients Suffering from Rheumatoid Arthritis.** ILAKI NOVOTNY. *Acta med scand.* 1948, 159: 524.

Clinical observations directed the author's attention to the possibility that after certain operations upon patients with rheumatoid arthritis there appears a phase in which the patient shows signs of possible desensitization. On the presumption that the course of the disease is connected to a large extent with allergic phenomena, he has tried to produce a state of desensitization by means of a new operative method. This method consists of transplantation of the diseased tissue of the capsule preferably from the patient's knee joint subcutaneously to the lower umbilical region. In 11 of the 12 cases described, there appeared a favorable postoperative reaction with reduction of pain and swelling and furthermore an increase of mobility of the joints. One patient did not react and the transplanted tissue became necrotic.

Seven patients have remained in a markedly better condition during the follow-up period of 9 to 17 months.  
KENNETH H. SPONDEL, M.D.

# SURGERY OF THE BLOOD AND LYMPH SYSTEMS

## BLOOD VESSELS

### Radioactive Sodium in Peripheral Vascular Disease Studies. BRYAN C. SMITH and EDNA H. QUINCY *Surg. Clin. N. America*, 1948, 23, 3004.

Radioactive sodium was first used by the authors for diagnostic purposes in peripheral vascular diseases at Presbyterian Hospital, New York, in 1943. They have used it in approximately 800 cases. This isotope as previously reported has given diagnostic, prognostic, and therapeutic information of a high degree of accuracy which has been of great benefit to patient and clinician.

In studies of peripheral vascular disease in the feet and legs, the patient lies on his back with his feet well separated. The counter is placed against the sole of the foot and a measured amount of radioactive sodium, usually about 100 microcuries in 3 to 7 c.c. of sterile normal saline, is injected into an antecubital vein. Precautions are taken to see that all of the material gets into the vein and that neither the patient nor the injector is contaminated by it, if the latter is going to handle the counter. The times of the beginning and end of the injection are noted. Registration of the arrival of the radioactive material at the sole of the foot is made by an audible signal from the Geiger counter which has an adjustable circuit so that the counting rate can be kept at a convenient level. Before injection there is a low background count due to cosmic rays and the presence in the vicinity of the apparatus of the radioactive material to be injected. When this material traverses the circulatory system and reaches the foot the counting rate increases sharply in this manner the arm-to-foot circulation time can be measured.

As the radioactive sodium leaves the capillaries and enters the extravascular fluid in the foot build up to equilibrium is manifested by the increase in counting rate. The "build up curve" is plotted in counts per minute for 30 to 45 minutes starting immediately after the injection. The rate of build-up and its final result depend upon the degree of patency of either the main artery or collateral circulation or both which is synonymous with the degree and type of pathologic changes in the walls of the arteries. For patients with various vascular disorders the curves may be within above, or below the range of normal readings. The very low curve may be due to thrombosis caused by arteriosclerosis, thromboangitis obliterans, endarteritis and other similar pathologic conditions and emboli. The degree of obstruction is dependent upon the degree of pathologic change present in the vessel wall. A high reading may result from inflammation or increased local blood supply due to vasodilation after the removal of normal vasoconstriction following peripheral nerve block, sympathectomy, or to idiopathic vasodilation as in erythromelalgia.

The authors do not attach as much clinical importance to the circulation time as might be the case were environmental conditions of temperature and those of the patients more constantly controlled. However a marked variance either a quickening or delay in the circulation time from that of normal as previously cited is of considerable clinical importance.

The authors present 15 cases with accompanying charts to illustrate the findings in various types of cases and to explain the diagnostic, prognostic, and therapeutic deductions made from the results of this method.

HERBERT F. THURSTON, M.D.

### The Treatment of Pulsating Exophthalmos Due to Aneurysm in the Carotid Sinus (Sul trattamento dell'esoftalmo pulsante da aneurisma seno-carotideo). PAOLO BIOCCA. *Polidinicio sez. chir.* 1947, 54, 234.

The author presents a case of pulsating exophthalmos. The patient entered the hospital on January 15, 1944. During a bombardment 4 months before admission he had been buried under debris of a fallen home and was unconscious for about 2 hours. Following this injury he suffered with severe head aches most marked in the right frontal region accompanied by a continuous rhythmic buzzing (tunnel murmur) and diminished vision in the right eye. There had been some otorrhagia at the time of the accident. A tumorfaction developed rapidly in the region of the right eye with marked ecchymosis and as the ecchymosis and edema subsided there developed a complete ophthalmoplegia. In the beginning the external rectus had been functioning. The right pupil showed moderate mydriasis and reacted a little to direct and consensual stimuli. The fundus showed marked turgor of the central vein. On auscultation a dull murmur was heard in the right orbital and temporal region with marked systolic accentuation. Digital pressure on the carotid artery caused the murmur and the subjective symptoms to disappear. The blood pressure was 165/65 and the red blood count 5,860,000.

Radiologic examination revealed an extensive recent fracture which extended into the right frontoparietal temporal region and into the base. The right frontal sinus and ethmoidal cells were moderately opaque. Angiographic studies were made by rapid injections of thorotrast (12 c.c.) and roentgenograms were taken at intervals of 3 seconds, 6 seconds and 8 seconds. In none of these was a filling of the arterial cerebral circle noted. In the first picture the carotid siphon, the cavernous sinus, the superior ophthalmic vein—markedly dilated and tortuous—the angular vein and anterior facial vein were filled with the opaque substance. In subsequent pictures a rapid emptying of the cavernous sinus followed by the ophthalmic and the facial sinuses was observed.



A diagnosis of aneurysm of the carotid sinus was established. Since the condition did not respond to conservative therapy surgical intervention was necessary to produce a stenosis of the internal carotid. This was done by means of a large silk ligature. The immediate postoperative result was good with disappearance of symptoms and a rapid reduction of the exophthalmos. After a period of a week, however the symptoms recurred at first slowly but then more rapidly until they became as intense as before operation.

A second operation was performed at which complete ligation of the internal carotid was accomplished. The patient withstood the operation very well. In a few days there was subsidence of all the vascular symptoms as well as rapid improvement of the ocular palsy. Paralysis of the fourth nerve only persisted for some time. The pulse rate dropped from 84 to 68 and remained at 68. The patient was seen 3 years later at which time he was considered to be completely and definitely cured.

The literature is extensively reviewed and numerous methods of surgical intervention are described. The author outlines his choice of treatment which consists in medical management associated with manual compression, which is gradually increased. The results would probably be negative in which case he would perform ligation of the internal carotid artery in 3 stages. The second intervention should completely occlude the vessel should be accomplished with extreme prudence and eventually completed by ligating the internal jugular vein. If this is not successful intracranial ligation of the internal carotid and electrocoagulation of the ophthalmic arteries should be performed.

LOUIE J. FREEDOTT, M.D.

**Oscillography and Arteriography for the Study of the Collateral Circulation in Arteriovenous Aneurysm** (Circolo collaterale oscillografico ed arteriografico nell'aneurisma arteriovenoso) D. VERRI. *Ann. Ital. chir.* 947 2415 L.

A 25 year-old military officer was struck by several fragments of an explosive shell. The tiny fragment entered the left arm up near the axilla and caused a vast tumefaction—later bloody discoloration and finally brownish discoloration of the skin of the region. A couple of weeks later it was observed that the resultant arteriovenous aneurysm had continued to enlarge rather rapidly with evidence of motor and sensory disturbances in the hand. This posed the question of urgent surgical interference. The oscillograph showed a fairly satisfactory circulation in the forearm and hand. Arteriography disclosed what appeared to be two aneurysmal sacs involving the brachial artery and vein. A tourniquet around the arm at the elbow improved the visualization of the vascular conditions so much that the collateral circulation, consisting of the profunda brachii artery and its branches, was clearly depicted.

At operation a ligature was passed around the brachial artery between the point of emission of the

profunda brachii branch and the aneurysmal sack. At the same time the oscillographic tracing for the forearm was repeated and disclosed what the author believed to be an adequate collateral circulation although the hand appeared pale and pulseless. Therefore the arteriovenous aneurysmal sack, together with the two additional traumatic sacs were totally extirpated with ligation of both afferent and efferent arterial and venous communications (quadruple ligation). Following the operation the hand remained warm but no pulse could be felt however within a few days the radial pulse began to be appreciable and the sensory and motor disturbances rapidly improved. Five months later the extremity had entirely recovered and the patient was at his usual work.

The author regards 5 or 6 weeks as being the usual minimal period for the development of a satisfactory collateral circulation in arteriovenous aneurysms. In this case the use of the oscillograph during the operation after temporary ligation of the afferent artery permitted the satisfactory condition of the circulation to the hand to be demonstrated clearly and thus allowed of a precocious operation seemingly indicated by the developing neurovascular disturbances in the hand.

JOHN W. BRENNAN, M.D.

**The Treatment of Arterial Embolism.** RICHARD WARREN and ROBERT R. LINTON. *N. England J. M.* 948, 384.

General conclusions concerning arterial emboli are that they usually occur in patients with heart disease who are in middle age, that the most common site of lodgment is a bifurcation of the femoral vessels, and that removal of the embolus before a period of 10 hours from onset has elapsed often, but not always, saves the limb. However improvements in conservative therapy—intermittent positive and negative pressure, intermittent venous occlusion, the oscillating bed, sympathetic block and anticoagulants—have relegated primary surgical attack to a secondary position.

The authors survey the records of 98 patients who suffered 7 arterial emboli during the period from 1937 to 1946 at the Massachusetts General Hospital, Boston. In 63.9 per cent of the patients the embolism occurred in the limbs. 83.7 per cent of the patients had a presumptive source of the emboli from within the heart, auricular fibrillation with auricular thrombosis was the major cause. The authors were unable to determine whether or not drugs to establish normal rhythm precipitated the embolism.

In the present series there were 46 females and 52 males. The average age of the patients was 57 with extremes of 22 years and 77 years. Arterial thrombosis and acute thrombophlebitis of the deep veins of an extremity must be considered in the differential diagnosis.

The authors devote the second half of their paper to a discussion of embolism to the arteries of the limb. If no treatment was instituted, 55 per cent of the affected limbs were saved. The prognosis in arterial emboli to the upper extremity is better than

that for arterial emboli to the lower extremity in the authors series all upper extremities were saved whereas 17 of 24 lower extremities were lost. Thus, the 55 per cent salvage for all limbs under no treatment is reduced to 29 per cent if only the lower limbs are considered.

The results with conservative measures (papaverine, paravertebral novocaine block, Pavax boot for the administration of intermittent suction and pressure intermittent venous occlusion and oscillating bed heparin) indicated a salvage of 25 limbs in 38 cases (65.8%) a similar analysis of emboli of the lower extremity indicated a salvage of 20 of 32 (62.5%) limbs. It was impossible to accurately evaluate the effectiveness of any one conservative measure.

Surgical treatment consisted of 25 operations on 21 patients for embolectomy 3 patients died so soon that evaluation of the effect of the operation was impossible. Of the 21 analyzable limbs 18 or 85.7 per cent survived. Thirty-eight of the 98 patients died in the hospital a mortality of 38.7 per cent, and all died of cardiovascular disease. It appeared that surgery itself was usually not harmful in these individuals.

Ten hours is considered the maximum period of grace for embolectomy to be successful. However surgery in peripheral embolism should not necessarily be abandoned because a temporal deadline has been passed. Much depends on the appearance of the limb. If actual gangrene has set in embolectomy is not to be considered. If however there is paralysis of the calf anesthesia of the foot, and marked vasospasm with a line of demarcation that is suggestive only embolectomy followed by conservative supportive measures should be performed.

The authors conclude that operation should be performed in all cases in which local anesthesia can be used, with the sole exception of popliteal emboli in which technical considerations intervene. Also aortic embolectomy is the treatment of choice for embolism of the aorta. Conservative treatment, although its results are good in some cases is justifiable only when the embolism obviously does not endanger the limb in the rare aortic embolism in which the patient is incapable of enduring the anesthetic and in popliteal embolism.

EDWARD H. CAMP M.D.

The Surgical Management of Venous Clotting  
GERALD H. PRATT *Surg Clin N America*, 1948, 28  
341

In surgery the pendulum of therapeutic opinion is seldom stationary but rarely is such an extreme oscillation encountered as is presently noted in the management of venous clotting. It is possible as pointed out by the author that sufficient time and experience have not elapsed to crystallize our therapeutic endeavors and therefore light our way

The clotting of blood occurs when the following conditions are present (1) an intrinsic change in the intravascular clotting factor (2) stasis and (3) tissue injury.

Other factors of importance are recognized and mentioned in this article. The predisposing factors of significance in venous clotting are (1) age (2) cardiovascular diseases (3) previous thrombosis (4) obesity (5) degenerating diseases and (6) fungus infections.

The author discusses the two types of venous clotting phlebotrombosis and thrombophlebitis. As a medical neologist he suggests that phlebotrombosis be called thrombosis, and in order to be consistent and avoid confusion of terms that thrombophlebitis be called thrombitis. This idea of simplification is indeed an important contribution to medical terminology.

The symptoms of thrombitis are listed in order of their frequency (1) pain at site and along vein, (2) redness along involved vein (3) swelling distal to inflammation, (4) tenderness along vein (5) fever (6) chills, and (7) leucocytosis.

Only 7 of the author's last 480 patients with thrombitis developed pulmonary embolism all of a minor type.

The symptoms of importance in thrombosis are listed in order of their significance in 90 patients with massive embolisms (1) pain usually in the popliteal space or calf (2) tenderness in the same area, (3) mild swelling (4) dilatation of veins over tibia, (5) cyanosis (6) increased pulse and temperature (7) sense of impending disaster (8) hypotension, and (9) embolism.

The author emphasizes the importance of prophylactic treatment. Weight reduction, abstinence from tobacco eradication of fungus infections correction of anemia, and early movement or ambulation are all discussed and considered to be necessary in the prophylaxis of venous clotting.

The active treatment of thrombosis is outlined as follows:

- 1 Vein resection (a) if early diagnosis (b) if anticoagulant therapy is ineffective (c) if embolism occurs (d) previous history of clotting (e) fear
- 2 Ambulation
- 3 Anticoagulant therapy dicumarol heparin early (contraindicated in some cases)
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The active treatment of thrombitis is outlined as follows (1) paravertebral sympathetic nerve block, (2) anticoagulant therapy (3) mobility active and passive, (4) heat, and (5) sympathectomy occasionally.

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A diagnosis of aneurysm of the carotid sinus was established. Since the condition did not respond to conservative therapy surgical intervention was necessary to produce a stenosis of the internal carotid. This was done by means of a large silk ligature. The immediate postoperative result was good, with disappearance of symptoms and a rapid reduction of the exophthalmos. After a period of 2 weeks, however the symptoms recurred at first slowly but then more rapidly until they became as intense as before operation.

A second operation was performed at which complete ligation of the internal carotid was accomplished. The patient withstood the operation very well. In a few days there was subsidence of all the vascular symptoms as well as rapid improvement of the ocular palsy. Paralysis of the fourth nerve only persisted for some time. The pulse rate dropped from 84 to 63 and remained at 63. The patient was seen 3 years later at which time he was considered to be completely and definitely cured.

The literature is extensively reviewed and numerous methods of surgical intervention are described. The author outlines his choice of treatment which consists in medical management associated with manual compression, which is gradually increased. The results would probably be negative in which case he would perform ligation of the internal carotid artery in stages. The second intervention should completely occlude the vessel should be accomplished with extreme prudence and eventually completed by ligating the internal jugular vein. If this is not successful intra-cranial ligation of the internal carotid and electrocoagulation of the ophthalmic arteries should be performed.

LOUISE J. FRODOTTI, M.D.

**Oscillography and Arteriography for the Study of the Collateral Circulation in Arteriovenous Aneurysm** (Circolo collaterale oscillografia ed arteriografia nell'aneurisma arteriovenoso) D. VENTRINI. *A. n. ital. chir.* 947 24 31

A 35-year-old military officer was struck by several fragments of an explosive shell. The tiny fragment entered the left arm up near the axilla and caused a vast tumorfaction. Later bloody discoloration, and finally brownish discoloration of the skin of the region. A couple of weeks later it was observed that the resultant arteriovenous aneurysm had continued to enlarge rather rapidly with evidence of motor and sensory disturbances in the hand. This posed the question of urgent surgical interference. The oscillograph showed a fairly satisfactory circulation in the forearm and hand. Arteriography disclosed what appeared to be two aneurysmal sacs involving the brachial artery and vein. A tourniquet around the arm at the elbow improved the visualization of the vascular conditions so much that the collateral circulation consisting of the profunda brachii artery and its branches, was clearly depicted.

At operation a ligature was passed around the brachial artery between the point of emission of the

profunda brachii branch and the aneurysmal sack. At the same time the oscillographic tracing for the forearm was repeated and disclosed what the author believed to be an adequate collateral circulation although the hand appeared pale and pulseless. Therefore the arteriovenous aneurysmal sack, together with the two additional traumatic sacks were totally extirpated with ligation of both afferent and efferent arterial and venous communications (quadruple ligation). Following the operation the hand remained warm but no pulse could be felt however within a few days the radial pulse began to be appreciable and the sensory and motor disturbances rapidly improved. Five months later the extremity had entirely recovered and the patient was at his usual work.

The author regards 3 or 6 weeks as being the usual minimal period for the development of a satisfactory collateral circulation in arteriovenous aneurysms. In this case the use of the oscillograph during the operation after temporary ligation of the afferent artery permitted the satisfactory condition of the circulation to the hand to be demonstrated clearly and thus allowed of a precocious operation seemingly indicated by the developing neurovascular disturbances in the hand.

JOSEPH W. BREWSTER, M.D.

**The Treatment of Arterial Embolism.** RICHARD WARREN and ROBERT R. LINTON. *Y. England J. M.* 943, 35 42

General conclusions concerning arterial emboli are that they usually occur in patients with heart disease who are in middle age that the most common site of lodgment is a bifurcation of the femoral vessels and that removal of the embolus before a period of 10 hours from onset has elapsed often but not always, saves the limb. However improvement in conservative therapy—intermittent positive and negative pressure intermittent venous occlusion, the oscillating bed sympathetic block and anticoagulants—have relegated primary surgical attack to a secondary position.

The authors survey the records of 98 patients who suffered 72 arterial emboli during the period from 1937 to 1946 at the Massachusetts General Hospital Boston. In 63.9 per cent of the patients the embolism occurred in the limbs 83.7 per cent of the patients had a presumptive source of the emboli from within the heart auricular fibrillation with auricular thrombosis was the major cause. The authors were unable to determine whether or not drugs to establish normal rhythm precipitated the embolism.

In the present series there were 46 females and 51 males. The average age of the patients was 52 with extremes of 12 years and 77 years. Arterial thrombosis and acute thrombophlebitis of the deep veins of an extremity must be considered in the differential diagnosis.

The authors devote the second half of their paper to a discussion of embolism to the arteries of the limb. If no treatment was instituted 55 per cent of the affected limbs were saved the prognosis in arterial emboli to the upper extremity is better than

that for arterial emboli to the lower extremity in the authors series all upper extremities were saved whereas 17 of 24 lower extremities were lost. Thus the 55 per cent salvage for all limbs under no treatment is reduced to 29 per cent if only the lower limbs are considered.

The results with conservative measures (papaverine paravertebral novocaine block, Pavaex boot for the administration of intermittent suction and pressure intermittent venous occlusion, and oscillating bed heparin) indicated a salvage of 25 limbs in 38 cases (65.8%) a similar analysis of emboli of the lower extremity indicated a salvage of 20 of 32 (62.5%) limbs. It was impossible to accurately evaluate the effectiveness of any one conservative measure.

Surgical treatment consisted of 25 operations on 21 patients for embolectomy 3 patients died so soon that evaluation of the effect of the operation was impossible. Of the 21 amputable limbs, 18 or 85.7 per cent survived. Thirty-eight of the 98 patients died in the hospital, a mortality of 38.7 per cent, and all died of cardiovascular disease. It appeared that surgery itself was usually not harmful in these individuals.

Ten hours is considered the maximum period of grace for embolectomy to be successful. However surgery in peripheral embolism should not necessarily be abandoned because a temporal deadline has been passed. Much depends on the appearance of the limb. If actual gangrene has set in embolectomy is not to be considered. If however there is paralysis of the calf anesthesia of the foot and marked vasospasm with a line of demarcation that is suggestive only embolectomy followed by conservative supportive measures should be performed.

The authors conclude that operation should be performed in all cases in which local anesthesia can be used, with the sole exception of popliteal emboli in which technical considerations intervene. Also aortic embolism is the treatment of choice for embolism of the aorta. Conservative treatment, although its results are good in some cases, is justifiable only when the embolism obviously does not endanger the limb in the rare aortic embolism in which the patient is incapable of enduring the anesthetic, and in popliteal embolism.

EDWARD H. CAMP, M.D.

The Surgical Management of Venous Clotting.  
GERALD H. PRATT, *Surg Clin N America* 1948, 23, 341

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Other factors of importance are recognized and mentioned in this article. The predisposing factors of significance in venous clotting are (1) age, (2) cardiovascular diseases (3) previous thrombosis (4) obesity (5) degenerating diseases and (6) fungus infections.

The author discusses the two types of venous clotting phlebotrombosis and thrombophlebitis. As a medical neologist, he suggests that phlebotrombosis be called thrombosis and, in order to thrombophlebitis be called thrombitis. This idea of simplification is indeed an important contribution to medical terminology.

The symptoms of thrombosis are listed in order of their frequency (1) pain at site and along vein, (2) redness along involved vein (3) swelling distal to inflammation, (4) tenderness along vein, (5) fever (6) chills and (7) leucocytosis.

Only 7 of the author's last 480 patients with thrombosis developed pulmonary embolism all of a minor type.

The symptoms of importance in thrombosis are listed in order of their significance in 90 patients with massive embolisms (1) pain, usually in the popliteal space or calf (2) tenderness in the same area, (3) mild swelling, (4) dilatation of veins over tibia, (5) cyanosis (6) increased pulse and temperature, (7) sense of impending disaster (8) hypotension, and (9) embolism.

The author emphasizes the importance of prophylactic treatment. Weight reduction abstinence from tobacco eradication of fungus infections correction of anemia, and early movement or ambulation are all discussed and considered to be necessary in the prophylaxis of venous clotting.

The active treatment of thrombosis is outlined as follows:

1. Vein resection (a) if early diagnosis (b) if anticoagulant therapy is ineffective (c) if embolism occurs (d) previous history of clotting (e) fear
2. Ambulation.
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The active treatment of thrombosis is outlined as follows (1) paravertebral sympathetic nerve block, (2) anticoagulant therapy (3) mobility active and passive (4) heat and (5) sympathectomy occasion ally.

The complications of edema ulcer and dilated veins are mentioned in conclusion of this practical and concise program for treating the patient with venous clotting.

EDWARD F. LAWSON, M.D.

A diagnosis of aneurysm of the carotid sinus was established. Since the condition did not respond to conservative therapy surgical intervention was necessary to produce a stenosis of the internal carotid. This was done by means of a large silk ligature. The immediate postoperative result was good, with disappearance of symptoms and a rapid reduction of the exophthalmos. After a period of 3 weeks, however the symptoms recurred, at first slowly but then more rapidly until they became as intense as before operation.

A second operation was performed at which complete ligation of the internal carotid was accomplished. The patient withstood the operation very well. In a few days there was subsidence of all the vascular symptoms as well as rapid improvement of the ocular pulsation. Paralysis of the fourth nerve only persisted for some time. The pulse rate dropped from 84 to 65 and remained at 65. The patient was seen 3 years later at which time he was considered to be completely and definitely cured.

The literature is tentatively reviewed and numerous methods of surgical intervention are described. The author outlines his choice of treatment which consists in medical management associated with manual compression which is gradually increased. The results would probably be negative in which case he would perform ligation of the internal carotid artery in 2 stages. The second intervention should completely occlude the vessel should be accomplished with extreme prudence and eventually completed by ligating the internal jugular vein. If this is not successful intracranial ligation of the internal carotid and electrocoagulation of the ophthalmic arteries should be performed.

LUCAS J. PROCTOR, M.D.

Oscillography and Arteriography for the Study of the Collateral Circulation in Arteriovenous Aneurysm (Circolo collaterale oscillografico e arteriografico nell'aneurisma arteriovenoso) D. VENTURA. *Atti clin. chir.* 937 24 3 L.

A 25 year-old military officer was struck by several fragments of an explosive shell. The tiny fragment entered the left arm up near the axilla and caused a small laceration—later bloody discoloration and finally brownish discoloration of the skin of the region. A couple of weeks later it was observed that the resultant arteriovenous aneurysm had continued to enlarge rather rapidly with evidence of motor and sensory disturbances in the hand. This posed the question of urgent surgical interference. The oscillograph showed a fairly satisfactory circulation in the forearm and hand. Arteriography followed what appeared to be two aneurysmal sacs in the right brachial artery and vein. A tourniquet around the arm at the elbow improved the visualization of the vascular conditions so much that the collateral circulation, consisting of the profunda brachii artery and its branches, was clearly depicted.

At operation a ligature was passed around the brachial artery between the point of emission of the

profunda brachii branch and the aneurysmal sack. At the same time the oscillographic tracing for the forearm was repeated and disclosed what the author believed to be an adequate collateral circulation although the hand appeared pale and pulseless. Therefore the arteriovenous aneurysmal sack, together with the two additional traumatic sacks were totally extirpated with ligation of both afferent and efferent arterial and venous communications (quadruple ligation). Following the operation the hand remained warm but no pulse could be felt; however within a few days the radial pulse began to be appreciable and the sensory and motor disturbances rapidly improved. Five months later the extremity had entirely recovered and the patient was at his usual work.

The author regards 5 or 6 weeks as being the usual minimal period for the development of a satisfactory collateral circulation in arteriovenous aneurysms. In this case the use of the oscillograph during the operation after temporary ligation of the afferent artery permitted the satisfactory condition of the circulation to the hand to be demonstrated clearly and thus allowed of a precocious operation seemingly indicated by the developing neurovascular disturbances in the hand.

JOHN W. BURNHAM, M.D.

The Treatment of Arterial Embolism. RICHARD WARREN and ROBERT R. LINTON. *N. England J. M.* 945, 38, 431.

General conclusions concerning arterial emboli are that they usually occur in patients with heart disease who are in middle age, that the most common site of lodgment is a bifurcation of the femoral vessels and that removal of the embolus before a period of 10 hours from onset has elapsed often, but not always, saves the limb. However improvements in conservative therapy—intermittent positive and negative pressure, intermittent venous occlusion, the oscillating bed, sympathetic block and anticoagulants—have relegated primary surgical attack to a secondary position.

The authors survey the records of 98 patients who suffered 172 arterial emboli during the period from 1937 to 1946 at the Massachusetts General Hospital, Boston. In 63.9 per cent of the patients the embolism occurred in the limbs, 85.7 per cent of the patients had a presumptive source of the emboli from within the heart, unicular fibrillation with auricular thrombosis was the major cause. The authors were unable to determine whether or not drugs to establish normal rhythm precipitated the embolism.

In the present series there were 46 females and 52 males. The average age of the patients was 52 with extremes of 12 years and 77 years. Arterial thrombosis and acute thrombophlebitis of the deep veins of an extremity must be considered in the differential diagnosis.

The authors devote the second half of their paper to a discussion of embolism to the arteries of the limb. If no treatment was instituted, 55 per cent of the affected limbs were saved, the prognosis in arterial emboli to the upper extremity is better than

that for arterial emboli to the lower extremity in the authors series all upper extremities were saved whereas 17 of 24 lower extremities were lost. Thus the 55 per cent salvage for all limbs under no treatment is reduced to 39 per cent if only the lower limbs are considered.

The results with conservative measures (papaverine, paravertebral novocaine block Pavacx boot pressure intermittent venous occlusion, and oscillating bed heparin) indicated a salvage of 25 limbs in 38 cases (65.8%) a similar analysis of emboli of the lower extremity indicated a salvage of 20 of 32 (62.5%) limbs. It was impossible to accurately evaluate the effectiveness of any one conservative measure.

Surgical treatment consisted of 25 operations on 21 patients for embolotomy 3 patients died so soon that evaluation of the effect of the operation was impossible. Of the 21 analyzable limbs, 18 or 85.7 per cent survived. Thirty-eight of the 98 patients died in the hospital a mortality of 38.7 per cent, and all died of cardiovascular disease. It appeared that surgery itself was usually not harmful in these individuals.

Ten hours is considered the maximum period of grace for embolotomy to be successful. However surgery in peripheral embolism should not necessarily be abandoned because a temporal deadline has been passed. Much depends on the appearance of the limb. If actual gangrene has set in embolotomy is not to be considered. If however there is paralysis of the calf anesthesia of the foot and marked vasospasm with a line of demarcation that is suggestive only embolotomy followed by conservative supportive measures should be performed.

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GERALD H. PRATT *Surg Clin. N. America*, 1948, 38  
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Only 7 of the author's last 480 patients with thrombitis developed pulmonary embolism, all of a minor type.

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In the present series there were 46 females and 52 males. The average age of the patients was 51 with extremes of 12 years and 77 years. Arterial thrombosis and acute thrombophlebitis of the deep veins of an extremity must be considered in the differential diagnosis.

The authors devote the second half of their paper to a discussion of embolism to the arteries of the limb. If no treatment was instituted, 55 per cent of the affected limbs were saved the prognosis in arterial emboli to the upper extremity is better than

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GERALD H. PRATT *Surg Clin N America* 1948 23 341

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The symptoms of importance in thrombosis are listed in order of their significance in 90 patients with massive embolisms (1) pain, usually in the popliteal space or calf (2) tenderness in the same area (3) mild swelling, (4) dilatation of veins over tibia, (5) cyanosis (6) increased pulse and temperature (7) sense of impending disaster (8) hypotension, and (9) embolism.

The author emphasizes the importance of prophylactic treatment. Weight reduction abstinence from tobacco, eradication of fungus infections correction of anemia and early movement or ambulation are all discussed and considered to be necessary in the prophylaxis of venous clotting.

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1. Vein resection (a) if early diagnosis (b) if anticoagulant therapy is ineffective (c) if embolism occurs (d) previous history of clotting (e) fear
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The complications of edema, ulcer and dilated veins are mentioned in conclusion of this practical and concise program for treating the patient with venous clotting.

EDWARD F. LEWIS M.D.



A diagnosis of aneurysm of the carotid sinus was established. Since the condition did not respond to conservative therapy surgical intervention was necessary to produce a stenosis of the internal carotid. This was done by means of a large silk ligature. The immediate postoperative result was good with disappearance of symptoms and a rapid reduction of the exophthalmos. After a period of 3 weeks, however the symptoms recurred at first slowly but then more rapidly until they became as intense as before operation.

A second operation was performed at which complete ligation of the internal carotid was accomplished. The patient withstood the operation very well. In a few days there was subsidence of all the vascular symptoms as well as rapid improvement of the ocular palsy. Paralysis of the fourth nerve only persisted for some time. The pulse rate dropped from 84 to 68 and remained at 68. The patient was seen 3 years later at which time he was considered to be completely and definitely cured.

The literature is extensively reviewed and numerous methods of surgical intervention are described. The author outlines his choice of treatment which consists in medical management associated with manual compression, which is gradually increased. The results would probably be negative in which case he would perform ligation of the internal carotid artery in 2 stages. The second intervention should completely occlude the vessel should be accomplished with extreme prudence and eventually completed by ligating the internal jugular vein. If this is not successful intracranial ligation of the internal carotid and electrocoagulation of the ophthalmic arteries should be performed.

LUCIAN J. FROST, M.D.

**Oscillography and Arteriography for the Study of the Collateral Circulation in Arteriovenous Aneurysm** (Circolo collaterale oscillografico ed arteriografico nell'aneurisma arteriovenoso) D. VENTURI. *Ann. Ital. chir.* 947 24 5

A 25 year-old military officer was struck by several fragments of an explosive shell. The tiny fragment entered the left arm up near the axilla and caused a vast tumefaction—later bloody discoloration, and finally brownish discoloration of the skin of the region. A couple of weeks later it was observed that the resultant arteriovenous aneurysm had continued to enlarge rather rapidly with evidence of motor and sensory disturbances in the hand. This posed the question of urgent surgical interference. The oscillograph showed a fairly satisfactory circulation in the forearm and hand. Arteriography disclosed what appeared to be two aneurysmal sacs involving the brachial artery and vein. A tourniquet around the arm at the elbow improved the visualization of the vascular conditions so much that the collateral circulation, consisting of the profunda brachii artery and its branches, was clearly depicted.

At operation a ligature was passed around the brachial artery between the point of emission of the

profunda brachii branch and the aneurysmal sack. At the same time the oscillographic tracing for the forearm was repeated and disclosed what the author believed to be an adequate collateral circulation, although the hand appeared pale and pulseless. Therefore the arteriovenous aneurysmal sack, together with the two additional traumatic sacs were totally extirpated with ligation of both afferent and efferent arterial and venous communications (quadruple ligation). Following the operation the hand remained warm but no pulse could be felt however within a few days the radial pulse began to be appreciable and the sensory and motor disturbances rapidly improved. Five months later the extremity had entirely recovered and the patient was at his usual work.

The author regards 5 or 6 weeks as being the usual minimal period for the development of a satisfactory collateral circulation in arteriovenous aneurysms. In this case the use of the oscillograph during the operation, after temporary ligation of the afferent artery permitted the satisfactory condition of the circulation to the hand to be demonstrated clearly and thus allowed of a precocious operation seemingly indicated by the developing neurovascular disturbances in the hand.

JAMES W. BRIDGMAN, M.D.

**The Treatment of Arterial Embolism.** RICHARD WARRER and ROBERT R. LINTON. *N. England J. M.* 945, 38 43

General conclusions concerning arterial emboli are that they usually occur in patients with heart disease who are in middle age that the most common site of lodgment is a bifurcation of the femoral vessels, and that removal of the embolus before a period of 10 hours from onset has elapsed often but not always, saves the limb. However improvements in conservative therapy—intermittent positive and negative pressure intermittent venous occlusion the oscillating bed sympathetic block and anticoagulants—have relegated primary surgical attack to a secondary position.

The authors survey the records of 98 patients who suffered 172 arterial emboli during the period from 1937 to 1946 at the Massachusetts General Hospital Boston. In 63 per cent of the patients the embolism occurred in the limbs 88.7 per cent of the patients had a presumptive source of the emboli from within the heart auricular fibrillation with auricular thrombosis was the major cause. The authors were unable to determine whether or not drugs to establish normal rhythm precipitated the embolism.

In the present series there were 46 females and 52 males. The average age of the patients was 52 with extremes of 18 years and 77 years. Arterial thrombosis and acute thrombophlebitis of the deep veins of an extremity must be considered in the differential diagnosis.

The authors devote the second half of their paper to a discussion of embolism to the arteries of the limb. If no treatment was instituted, 55 per cent of the affected limbs were saved the prognosis in arterial emboli to the upper extremity is better than

that for arterial emboli to the lower extremity in the authors series all upper extremities were saved whereas 17 of 24 lower extremities were lost. Thus, the 55 per cent salvage for all limbs under no treatment is reduced to 39 per cent if only the lower limbs are considered.

The results with conservative measures (papaverine, paravertebral novocaine block Pavacox boot for the administration of intermittent suction and pressure intermittent venous occlusion, and oscillating bed heparin) indicated a salvage of 25 limbs in 38 cases (65.8%) a similar analysis of emboli of the lower extremity indicated a salvage of 20 of 32 (62.5%) limbs. It was impossible to accurately evaluate the effectiveness of any one conservative measure.

Surgical treatment consisted of 25 operations on 21 patients for embolectomy 3 patients died so soon that evaluation of the effect of the operation was impossible. Of the 21 analyzable limbs 18 or 85.7 per cent survived. Thirty-eight of the 98 patients died in the hospital, a mortality of 38.7 per cent, and all died of cardiovascular disease. It appeared that surgery itself was usually not harmful in these individuals.

Ten hours is considered the maximum period of grace for embolectomy to be successful. However surgery in peripheral embolism should not necessarily be abandoned because a temporal deadline has been passed. Much depends on the appearance of the limb. If actual gangrene has set in, embolectomy is not to be considered. If however there is paralysis of the calf anesthesia of the foot, and marked vasospasm with a line of demarcation that is suggestive only embolectomy followed by conservative supportive measures should be performed.

The authors conclude that operation should be performed in all cases in which local anesthesia can be used, with the sole exception of popliteal emboli in which technical considerations intervene. Also aortic embolism is the treatment of choice for embolism of the aorta. Conservative treatment, although its results are good in some cases is justifiable only when the embolism obviously does not endanger the limb in the rare aortic embolism in which the patient is incapable of enduring the anesthetic, and in popliteal embolism.

EDWARD H. CAMP M.D.

*The Surgical Management of Venous Clotting*  
GERALD H. PRATT *Surg. Clin. N. America*, 1948, 28  
341

In surgery the pendulum of therapeutic opinion is seldom stationary but rarely is such an extreme oscillation encountered as is presently noted in the management of venous clotting. It is possible, as pointed out by the author that sufficient time and experience have not elapsed to crystallize our therapeutic endeavors and therefore light our way.

The clotting of blood occurs when the following conditions are present (1) an intrinsic change in the intravascular clotting factor (2) stasis, and (3) tissue injury.

Other factors of importance are recognized and mentioned in this article. The predisposing factors of significance in venous clotting are (1) age (2) cardiovascular diseases (3) previous thrombosis (4) obesity (5) degenerating diseases and (6) fungus infections.

The author discusses the two types of venous clotting phlebothrombosis, and thrombophlebitis. As a medical neologist he suggests that phlebothrombosis be called thrombosis, and in order to be consistent and avoid confusion of terms that thrombophlebitis be called thrombitis. This idea of simplification is indeed an important contribution to medical terminology.

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EDWARD F. LEWISON M.D.

# SURGICAL TECHNIQUE

## ANESTHESIA

**Studies on the Parenteral Administration of Hydrogen Peroxide.** A. L. LORINCZ, J. J. JACOBY and H. M. LEVINCROSS. *Anesthesiology* 948, 9: 163

This investigation revealed that in animals with sufficient blood catalase, hydrogen peroxide can be given intravenously with effects similar to those following the intravenous administration of oxygen. Significantly larger amounts of oxygen, however are tolerated in the form of hydrogen peroxide. The intravenous method of administering hydrogen peroxide is quite simple and the dosage can be readily controlled.

In animals very little therapeutic value could be established for the intravenous administration of hydrogen peroxide. It must be recalled, however that in animals similar poor results are reported for the intravenous administration of oxygen, while in man clinically beneficial results are recorded. Therefore, it seems indicated that further cautious clinical experiments be carried out with the intravenous administration of hydrogen peroxide as a substitute for the intravenous administration of oxygen.

MARY FRANCES POE, M.D.

**Infiltration Anesthesia in Inflamed Tissues (Die Infiltrationsanästhesie im entzündeten Gewebe)** ARVID MORICZ. *Arch. Forsch.* 947: 303, 336.

The literature abounds with warnings that local anesthesia in the form of an infiltration technique should not be used in inflamed tissues. The author says that his experiences in war surgery and then in civil practice, have not found these warnings valid. Both the inability of the inflamed tissues to become anesthetized and the possible ill effects of the local infiltration of anesthetic media have been used as reasons for avoiding infiltration methods in infected tissues. The author believes that these warnings have been based purely on theoretical grounds.

In a review of the literature and his own investigations, the author states that the pain which occasionally follows the infiltration of an anesthetic in an inflammatory field is due to a lack of isotonicity and a difference in the pH of the injected medium. This can be overcome by the use of freshly prepared solutions of the anesthetic medium which can be properly buffered. The objection that the medium will be more rapidly absorbed by the hyperemic tissues is more theoretical than real, according to experiments quoted by the author. He dwells much on the theory that the infection may of itself spread the bacteria and infected material. This, he states, is not the case. In most of the instances of infection, the tissues are almost immediately drained by incision, so that there need be no danger from spread. The para-aminobenzoic acid factor which renders the procaine infiltrated tissues less susceptible to the

action of the sulfa drugs, can be avoided by the use of pontocaine which does not possess this factor. Furthermore, the author believes that the local anesthetic has a beneficial effect on the tissues in alleviating pain. The pain, in his opinion is not caused so much by the hydrostatic pressure of the exudate, but rather by the irritant action of the protein particles in the nerve endings. By obviating this pain vasodilatation takes place and the infection is further combated.

Several precautions were observed by the author in his series of almost 2,000 cases. The solution was always freshly prepared, and the syringes and needles carefully sterilized in distilled water so that they would not be alkaline. Adrenalline was used in all instances. The injections were made very slowly into normal tissues, especially into the skin and subcutaneous tissues. After the infiltration a waiting period of at least 10 minutes was employed to insure anesthesia. Dilute solutions were used in the bladder, rectum, and bronchi, as absorption in these areas is especially enhanced.

WILLIAM C. BUCK, M.D.

**Pentothal-Curare Solution: A Preliminary Report and Analysis of Its Use in 168 Cases.** JOE W. BAIRD, WARD R. JOHNSON and FREDERICK H. VAN BERGEN. *Anesthesiology* 948, 9: 14

Pentothal-curare solution in combination with nitrous oxide has been used as a general anesthetic in more than 1,400 cases. This solution contains 5 units of d-tubocurarine chloride and 25.75 or 25 mgm. of pentothal sodium per cubic centimeter.

The authors have been greatly impressed by the adaptability of this anesthetic to practically all types of procedure, particularly those lasting over 30 minutes. At the present time it is believed that this is the general anesthetic of choice in the elderly chronic, debilitated patient, and in extremely poor risks.

The complications arising during this anesthesia were relatively few. The most distressing one was hiccup. In a few cases excessive salivation was encountered. Foremost among the advantages is the minimal effect upon the cardiac conduction mechanism. Another outstanding advantage of this combined anesthetic is the elimination of explosion hazards.

A history of asthma or the presence of myasthenia gravis is considered a contraindication to the use of pentothal-curare solution.

MARY FRANCES POE, M.D.

**The Influence of Posture on Mechanics of Respiration and Vital Capacity.** CHARLES RONALD STEVEN. *Anesthesiology* 948, 9: 134.

A recent theory of pulmonary mechanics shows that the outward movements of the thoracic wall are of prime importance in expansion of the lungs. As a result of posture on the operating table, external

pressure may be applied in such a way as to prevent normal expansion. Tests with normal healthy individuals showed that the vital capacity varies according to the posture of the subject. The influence of gravity on the relaxed individual was noted as well.

Certain measures which tend to offset the deleterious effects of posture and gravity have been described. Sponge rubber chest and abdominal supports allow freer movements of the chest and abdomen when the patient is in the prone position. Elevation of the lower extremities compensates for the effect of gravity when the patient is in the upright position.

MARY FRANCES POZ, M.D.

**Rationale and Hazards of Pressure Breathing and Oxygen Therapy** H. W. RYDER and R. A. KENOR. *Anesthesiology* 1948, 9 21

Inhalation therapy with oxygen has become a major item in general therapy as attested to by the tenfold increase in consumption of medical oxygen during the period from 1930 to 1947. The authors ask two significant questions concerning this trend: (1) "Is there justification for the emphasis being placed upon oxygen therapy?" (2) "Are there hazards from administering oxygen indiscriminately?" In clarifying these questions, they present a discussion of their experimental observations on healthy adults and on diseased patients. They point out that cerebral oxygen uptake is not improved materially by excess oxygen in the environment if some specific condition prohibits this uptake.

Physiologic effects of oxygen and pressure breathing in health and in illness are discussed. In the healthy subject increase of alveolar oxygen tension leads to increased arterial oxygen tension with an increase in carbon dioxide tension of arterial blood. The carbon dioxide combining power of venous blood increases also. Superatmospheric oxygen tensions in animals have been shown to give increased carbon dioxide tension in arterial blood. The authors believe this is best explained by the retention of carbon dioxide due to lessened sensitivity of the respiratory centers to carbon dioxide in the presence of high oxygen tension. When oxygen is given in sufficiently high concentration for hours or days it depresses slightly the oxygen carrying capacity of the blood and has uniformly toxic effects upon animals and certain toxic effects upon representative groups of healthy men."

Pressure breathing can actively inflate the lungs, but cardiac output is uniformly reduced in healthy men and syncope is more easily induced. At the same time apnea is more or less difficult to avoid during pressure breathing. Pressure on the heart and great

vessels is increased and thereby venous return and pulmonary edema are decreased.

In clinical application one finds that specific types of anoxia require specific therapy. Oxygen is often used empirically on the basis that it is the 'common denominator' of anoxic states. However the authors believe that the value of this 'common denominator' remains to be shown since oxygen is not always common to biologic oxidations.

In conclusion the authors suggest that the treatment of anoxic states usually requires more than oxygen therapy. They believe the foremost hazard of oxygen therapy is the neglect of the primary cause of the anoxia. As the principal value of pressure breathing is related to decreasing venous return to the right heart, pulmonary edema is one of the primary indications for such therapy.

MARY KARP, M.D.

**Anesthetic Problems in Thoracic Surgery** ELMER R. MAUREX. *Anesthesiology* 1948 9 183

In candidates for thoracic surgery the stage is already set for a complicating anoxic anemic anoxemia and postoperative shock. The demand for oxygen will be great and the dangers of suffocation constantly confront the anesthesiologist. Careful attention to patency of the airway, adequate oxygenation during anesthesia and the replacement of blood as it is lost during the operation will do much to prevent anoxia.

In the opinion of the author nitrous oxide, oxygen and ether administered endotracheally through a closed apparatus, constitute the preferred anesthetic.

MARY FRANCES POZ, M.D.

**Neosynephrin Hydrochloride in Anesthesia and Shock.** GEORGE J. THOMAS and PAUL A. SICA. *Current Res Anesth* 1948, 27 101

From their study on the use of neosynephrin hydrochloride the authors are of the opinion that this compound represents the most suitable of the vasoconstrictor substances. It does not produce stimulation of the central nervous system nor increase the irritability of the conducting tissues in the heart. This is the only known sympathomimetic compound that is safe for use with cyclopropane anesthesia or any other anesthetic agent.

They have found that venoclysis with glucose and neosynephrin solution is the surest way to maintain the blood pressure within normal limits during spinal analgesia. Nausea and vomiting usually present are practically nonexistent. Sufficient pentothal is administered to provide analgesia. The apparatus used is described.

MARY FRANCES POZ, M.D.

# PHYSICO-CHEMICAL METHODS IN SURGERY

## ROENTGENOLOGY

Vasokymogram and Vascular Flow (Vasokymogramm und Gefäßströmung) M. ZEHNDER. *Helvet. chir. acta* 1948, 5 65.

Despite the drawbacks due to the presence of the image of the screen, kymography is the simplest method to demonstrate on one film the passage of contrast medium through the vessels during a certain period. In addition, it allows temporal measurement of the flow and this may be valuable for the diagnosis of pathologic vascular changes (retardation in the cerebral pressure, vascular choking in the vicinity of the tumor, retention of contrast medium in the area (ter disappearance from the principal vessels).

The specific advantage of kymography lies in the possibility of following the passage of a small amount of contrast medium over a prolonged exposure time and thereby demonstrating the arterial as well as the venous flow on the same film. This broadens the diagnostic possibilities. Delays in the blood flow within organs can thus be clearly observed, for instance at sites of pathologic vascular proliferations as in tumors.

Zehnder has used a horizontally running kymograph with electric motor drive, the rapidity of which could be regulated for various predetermined periods. In experiments on rabbits he has used 7 seconds for the demonstration of the vessels of the extremities. For the human head the period is limited by the capacity of the tube which must work under a higher load to penetrate the bones of the cranium. Up till now he has reached periods of from 3 to 4 seconds from 5 to 6 seconds would be ideal to demonstrate the entire passage of contrast medium through the cerebral vessels. By preliminary injection of the medium in the usual amount it is possible to obtain a complete arterial picture and in addition, to catch also the capillary phase and the venous filling during the subsequent 3 to 4 seconds. The pictures obtained in model and animal experiments are a great help in determining the time taken by the passage of the contrast medium.

In one of the animal experiments, in which Zehnder made an involuntary retrograde injection of the descending aorta, he obtained a picture of the arterial and venous vascular system of the left kidney. From this he concluded that vasokymography could be used for renal diagnosis in appropriate cases. By compressing the aorta distally from the origin of the renal arteries and injecting the medium proximally into the aorta, it should be possible to demonstrate the renal circulation. The diagnostic advantages of such a performance are evident, as it would serve to determine the size of the organ, deformities, vascular anomalies and certain pathologic changes.

The author cites 3 cases. In the first 40-year-old woman had severe localized, frontoparietal head

aches on the left side and a normal encephalogram. The arteriogram and the kymogram showed no special vascular connection with the localized frontoparietal shadow seen in the left hemisphere and limiting convulsions here and there. This was localized Sturge-Weber disease (subcortical calcification) without vascular participation. In the second case there was a 54 year-old woman with a round cell sarcoma below the left elbow; the kymogram taken over a 5 second period showed clearly the vascular relations of the tumor and its vicinity and the venous return flow. RICHARD KRESEL, M.D.

A Subdural Hematoma Outlined with Air in the Encephalogram. OLLE OLSSON. *Acta radiol. Stockh.* 1948, 29, 95.

A case of a verified subdural hematoma is presented in which a small amount of subdural air was made to outline the hematoma by an appropriate change in the position of the patient's head. The usual methods of encephalography and ventriculography do not show pathognomonic signs of this condition. However, one case described by Dyke in 1936 was an exception.

The author's case was a typical one of subdural hematoma, namely, trauma was followed 2 months later by signs and symptoms of increased intracranial pressure, with localizing signs placing the lesion on the right side of the patient's head in the parietal region. Encephalography showed the septum pellucidum to be displaced 2 cm. to the left of the midline. The entire right lateral ventricle was pushed in under the falx cerebri, and the right inferior horn was displaced slightly medially. Air was present subarachnoidally over the left hemisphere. The greater part of the subarachnoid space over the right hemisphere showed no filling. A small amount of air was present in the subdural space over the convexity. On tilting of the patient's head to the left the subdural air on the right side moved lateralward, and formed a curved column of air with the concavity facing lateralward. Lateral to this column of air was a dense homogeneous area with a convex medial outline. Operation confirmed that this column of air outlined a subdural hematoma.

The author believes that the air in this case entered the subdural space through a rupture of the arachnoid. He suggests that a rupture of this kind may be caused by absorption of the hematoma. When absorption sets in, adhesions between the inner membrane of the hematoma and the arachnoid may lead to rupture of the arachnoid. The subdural space caused by this absorption does not fill in immediately but the air enters it, and in this way surrounds the hematoma.

The author presents this as a pathognomonic encephalographic picture of a subdural hematoma.

JONAS W. HOFF, M.D.

**Pneumoencephalographic Diagnosis in the Presenile Dementias.** PAUL CRODOFF, ALEXANDER SIDON and WALTER FREEMAN. *Am. J. Roentg.* 1948, 59 332

The authors have reviewed the literature with regard to the encephalographic diagnosis of the presence or absence of presenile dementia and the differential diagnosis between Pick's disease and Alzheimer's disease. It had been thought by some authors that these two diseases could be distinguished by ventricular dilatation and characteristic distribution of abnormal cortical air, while others had not been of this opinion.

Nine cases are presented, in which the pneumoencephalogram was evaluated both in the delimitation of the presenile group from other cases and in the differential diagnosis of Pick's disease and Alzheimer's disease. In all cases the diagnosis of presenile dementia was made on the basis of a progressive organic dementing process without evidence of any other etiology. Eight of the 9 patients died and autopsies were performed.

The air study revealed ventricular dilatation in all cases. In 7 of the 9 cases very little extracortical air was visible and no conclusion could be drawn as to the presence or absence of localized extracortical air. In 2 cases large collections of air presented the appearance of cortical atrophy. Examination at autopsy confirmed the ventricular dilatations but did not demonstrate cortical atrophy in the suspected patients in whom the condition had been diagnosed by pneumoencephalogram.

The authors were unable to substantiate by roentgenography the work of others regarding the differentiation of Pick's disease and Alzheimer's disease. The utility of reliance on the roentgen ray was further substantiated by the pathologic diagnosis established at autopsy. It was further found that the condition in 2 cases in the group belonged to neither of the diseases under discussion but had the roentgen appearance described by others as characteristic. The authors therefore concluded that air encephalography was of little value as a means of differentiation among the various members of the presenile group but was very valuable as a means of separating the degenerative presenile cases from those with other conditions.

HORACE G. BUTLER, M.D.

**Pantopaque Myelography in the Diagnosis of the Arnold-Chiari Malformation.** BERNARD S. EATKIN. *Am. J. Roentg.* 1948, 59 339

This article deals with the report of a case of Arnold-Chiari malformation without associated skeletal or central nervous system defects, a review of previously reported cases and a discussion of the findings in this condition by pantopaque myelography.

The author states that the case presented is the fourth such case to be reported. The patient was a female 30 years of age who complained of pain and abnormal sensations in her left shoulder with radiation to the hand. Examination and study in-

dicated a lesion in the upper cervical cord. Myelography was interpreted as indicative of an intrinsic lesion probably an extramedullary tumor. Operation revealed an Arnold-Chiari malformation without skeletal or brain defects.

The myelographic findings described by the author as characteristic of this deformity consist of (a) in the direct anteroposterior projection of the head a bilateral concavity of the oil in the cisternae magna pontis, and interpeduncularis separated by a column of oil in the midline and (b) the configuration of the oil seen in the cisternae magna with the patient's head turned to the right or left was a slightly cephalad convexity whereas normally it is concave caudad following the normal contour.

The symptomatology of the condition in this and the previously reported cases is stated to be rather bizarre, cerebellar tumor being the most frequent preoperative diagnosis.

The myelographic findings described correspond with those reported previously as quoted by the author. Correlation of the findings with the illustrations was not entirely satisfactory. However as the author suggests the procedure of myelography in such cases may have definite application in the clinical investigation. PAUL R. NOBLE, M.D.

**Thoracic Aortography.** B. BRODÉN, H. E. HANSON and J. KARNELL. *Acta radiol.*, Stockh., 1948 29 181

A method of thoracic aortography through the introduction of a heart-catheter (8-9F) into one of the radial arteries after exposure in the fossa cubiti is described. Preliminary sedation and a local anesthetic are used. A compression device is placed over the abdomen to compress the abdominal aorta and delay the transport of the contrast substance from the thoracic aorta. The opposite arm is equipped with a pressure cuff filled above the systolic pressure. Fifty cubic centimeters of a 70 per cent solution of diodrast are injected with an ordinary syringe as fast as possible. Roentgenograms are made in two perpendicular directions simultaneously and at a speed of one pair per second.

This study has been carried out on 3 patients suspected of having a coarctation of the aorta or patent duct of Botallio. In the first patient, previous heart catheterization with gas analysis suggested the diagnosis of a patent duct of Botallio but no murmur could be heard or recorded which made the diagnosis uncertain. Subsequent thoracic aortography showed no evidence of a communication between the aorta and the pulmonary artery. A coarctation of the aorta was demonstrated in the second patient and a coarctation of the aorta with an associated patent duct of Botallio was found in the third patient.

Brief case reports on these three patients, together with the roentgenograms are included in this report. The results were so satisfactory that the authors plan to use this method instead of angiocardiology for contrast roentgenography of vascular malformations in the aorta and its intrathoracic branches.

JOHN H. FRED, M.D.

**Seriographic Studies in the Roentgenologic Exploration of the Respiratory System** (L'indagine seriografica nell'esplorazione radiologica dell'apparato respiratorio) LUIGI CASTALDI. *Radiol med* Milano, 1948, 34, 65

Roentgenoscopy and roentgenography supplement one another and neither can be spared. The former method has the advantage of showing the different phases of a lesion as viewed directly on the fluoroscopic screen but has at the same time the disadvantage of failing to demonstrate details the latter method has, on the contrary the advantage of showing details but lacks in mobility. The method of roentgenography in series was designed by Busi in 1913 to remedy these defects.

The type of apparatus which is employed for this purpose consists essentially of a plate opaque to the roentgen rays in which is left an opening, a window measuring 9 by 12 cm. In this opening is fitted a fluorescent screen. To this plate is attached a mechanism consisting of a cassette (chamela) containing the roentgenographic film. By this mechanism the film can be moved in front of the opening in the plate and then shifted in different directions, with the result that 4 different views of the part under examination can be photographed. The process to be filmed is watched on the fluorescent screen until the particular phase to be fixed on the film is observed.

This method has previously been used almost exclusively in the study of the gastroduodenal tract (duodenum). The author now proposes that it be employed in the study of lesions of the respiratory apparatus. By this means the number and extent of the pleural adhesions in the process of pneumolysis during the operation of pneumothorax (J. cobueus operation) may be demonstrated. Images, which by the standard method of roentgenography might be interpreted as pulmonary cavities (pseudocavities) or as milary or nodular tuberculosis, may be clarified as to their true nature. The difference between the pulmonary cavity and bronchiectatic dilatations may be demonstrated especially with the aid of insufflation of iodized oil. Finally the steps of the treatment of the pulmonary cavity by the method of intracavitary aspiration, as used by the author's chief V. Monaldi, may be observed.

JAMES W. BRIDGMAN, M.D.

**The Roentgen Examination of the Mediastinal Lung Hernia with Reference to Tomography** ILARIO SALICRÚ. *Acta radiol* Stockh., 1948, 29, 30.

The author states that in this article the term of "hernia" is used with full recognition of the fact that there is a difference of opinion as to whether one is dealing with a true herniation or a local displacement of the mediastinum only.

There are two types of mediastinal hernia: one is caused by pulsion, as for example in pneumothorax, and the other is caused by traction due to diminished pressure certain anatomic conditions, leading to cir-

cumscribed resilient areas in the mediastinum, are the contributory factors. Nitsch described two such resilient areas: the first behind the manubrium sterni at the level of the insertion of the first to third ribs and the second in the lower posterior mediastinum at the level of the fifth to eleventh dorsal vertebrae. Bárány and Ward described a third weak place between the spinal column and esophagus at the level of the third to fifth dorsal vertebrae.

The pulsion hernia is well demonstrated fluoroscopically. A sharply defined translucent area appears during expiration within the normal lung near the mediastinum at the level of the anterior ends of the first to third ribs. During inspiration the area gradually diminishes in size or disappears totally. This area corresponds to an air filled pouch of the opposite pleura.

The traction hernia is comparatively rare although Maye of the University of Michigan, described 30 cases. The author himself saw 6 cases in short time. The condition usually is the result of a shrinking of the lung (tuberculosis, bronchiectasis) or of chronic bronchostenosis (tumor foreign body). Lobectomy and pleural adhesions may enhance the formation of a traction hernia.

The roentgen diagnosis of traction hernia is based on a careful observation of the translucent area. In case of shifting of the mediastinum due to contraction of the hemithorax one should always search for a traction hernia. In the routine roentgenograms the hernia is often overlooked. An exposure with more penetrating roentgen rays is necessary to bring out the details to better advantage. Then the area is seen paramediastinally on the opaque side outlined by a horizontal upper border which crosses the mediastinum at the level of the sternoclavicular joint and turns downward laterally. The lateral border changes with the size of the hernia.

However often not even the more penetrating exposure is sufficient to demonstrate the traction hernia. Stereoscopic films roentgenograms taken in a lateral or oblique view and bronchograms are of little additional value. In such instances tomography may be of considerable help by visualizing the changed position of the pulmonary vessels in the area under question. Normally, the blood vessels are shown best in the tomographic layers of 9 to 11 cm. whereas in herniation they appear the clearest in the layers of 12 to 14 cm. This occurred in 5 of 6 of the author's cases.

The 6 cases are briefly described and the respective roentgenograms and some diagrams are used for the purpose of illustration. The cause of the mediastinal hernia was given as pneumoectomy in 1 case, lobectomy in 1 case shrinking after discontinuation of pneumothorax in 3 cases, and pleural adhesions in 1 case. In all 6 cases, part of the healthy upper lobe of the lung herniated into the diseased side through the weak spot of the upper anterior mediastinum. In one case there was also overlapping in the region of the lower posterior resilient area.

T. LECHE, M.D.

**Early Pleural Effusion in Pulmonary Embolism and Pneumonia or Bronchopneumonia** GUMMAR  
MORBERG *Acta radiol. Stockh.*, 1948 29 7

The roentgen diagnosis of pulmonary embolism has previously been based on the demonstration of the characteristic triangular infarct shadow with its base facing the pleura and the apex pointing toward the hilus. In order that the infarct should appear as a triangular shadow on the roentgenogram, however it would be necessary for the roentgen rays to strike the triangle from the side at an angle which does not diverge too much from 90 degrees. Otherwise an uncharacteristic shadow would be obtained. Recently it has been proved that the wedge-shaped shadow with its apex toward the hilus is not characteristic of a pulmonary infarct. Pulmonary embolism may often occur without any demonstrable density in the parenchyma of the lung.

Pulmonary embolism usually leads to changes in the pleura. There is a frequent relationship between pleural effusion and infarction. To estimate the significance of early pleural effusion in pulmonary embolism the author has studied the findings in 46 patients with pulmonary embolism roentgenographed within 3 days of the appearance of symptoms, and 38 patients with pneumonia or bronchopneumonia examined within 6 days of the onset to determine the significance of an early pleural effusion from the differential diagnostic standpoint. In about half of the cases of pulmonary embolism the pleural effusion dominated over the parenchymal density while in a little less than half the reverse was true. In 2 of the 38 cases of pneumonia and bronchopneumonia the pleural effusion dominated and in 3 cases the pleural effusion and the parenchymal density were equally dominant. All of the 5 patients were examined within 3 days of the first symptom. In the 33 other patients 18 of whom were examined within 3 days the parenchymal density was the dominating roentgen finding. It can be said that an early pleural effusion when there are no or only small, parenchymal densities is common in postoperative pulmonary embolism but less common in a medical series of pneumonia or bronchopneumonia cases. In a considerable proportion of cases of pulmonary embolism large parenchymal densities occur without demonstrable pleural effusion or with only slight pleural effusion.

FRANK L. HICKEY, M.D.

**Accidental Extrapleural Pneumothorax** OTTE OLSSON  
*Acta radiol. Stockh.*, 1948 29 117

While performing an artificial pneumothorax for collapse therapy the parietal pleura may be stripped from the chest wall and smaller or larger quantities of gas deposited extrapleurally.

After a brief review of the literature the author reports 7 cases of accidental extrapleural pneumothorax which he observed during the past 2 years. The case histories are briefly given, emphasis being laid on the roentgen findings. The respective roentgenograms and one diagram are used for the purpose of illustration.

The anatomic background of an extrapleural pneumothorax is explained as follows.

The thoracic cavity is lined first with the endothoracic fascia which is firmly attached to the periosteum of the ribs and the aponeuroses of the intercostal muscles, then with the parietal pleura which can be separated from the fascia over almost its entire extent along the chest wall. By using a coarse blunt needle or a needle with a long opening one may easily strip off the parietal pleura instead of going through it and thus an accidental extrapleural pneumothorax is produced. A warning sign is that in such an instance the pressure rises rapidly during the course of the injection of the gas although this was not observed in the author's cases.

The most important roentgen findings are a column shaped collection of gas when the pleura is separated from the chest wall over a large extent or a cyst shaped area when the detachment of the pleura is limited. In contradistinction to the ordinary pneumothorax which is delineated by a membrane hardly a millimeter thick the extrapleural pneumothorax represents an entirely free space the size of which varies greatly from case to case and depends on the amount of gas deposited extrapleurally. Another distinguishing feature is the fact that an extrapleural pneumothorax takes a very long time to absorb. In one case the gas was still present after 2 years.

Accidental extrapleural pneumothorax is not uncommon. However it is recognized in the majority of cases only if it is especially looked for. Its clinical significance lies in the fact that (1) it may produce pain in the hypochondrium and a "tight feeling" in the chest (2) it may lead to confusion with adhesions, in which case the collapse therapy is unnecessarily discontinued (3) the increased manometric pressure may appear puzzling and induce abandonment of collapse therapy and (4) the extrapleural deposit of gas brings the two pleural sheaths closer to one another facilitating the formation of adhesions especially in the later stages because of the further absorption of the gas in the intrapleural cavity. The latter phenomenon may eventually lead to a gradual reduction and complete destruction of the pneumothorax cavity on subsequent refills.

T. LECUTIA, M.D.

**Alterations of the Thoracic Bones in the Diagnosis of Pulmonary Tumors** (Le alterazioni dello scheletro toracico nella diagnosi dei tumori polmonari)  
GIOVANNI GARDELLA *Radiol. med. Milano* 1948 34 146

Up to the present time little attention has been paid to the lesions of the thoracic bones in cases of pulmonary tumor and yet they are often very important from the diagnostic point of view. They may be due to spread of the tumor to the bone or to compression of the bone by the tumor. The first type is more frequent than the second and may be due to metastasis or to spread by contiguity.

In a study of 40 cases of primary tumor of the lung the author found bone changes in 10 or 25 per



cent. The most frequent changes were those which belong to the Pancoast syndrome (osteolytic changes of one or more ribs in their posterior portion and sometimes also of the corresponding vertebrae) other changes consisted of osteolytic patches in segments of the ribs or of the clavicle sometimes large and sometimes so small that they easily escaped observation. Often the massive opacity of the pulmonary tumor or of the relative atelectasis was the reason why these lesions especially when they were small, were easily overlooked. Therefore the author finds it advisable to call attention to the necessity of studying the thoracic cage every time the suspicion arises that a pulmonary infiltration might be due to a neoplasm. In these cases films should be taken with appropriately hard rays in the various positions which allow observation of all the bone segments of the chest and the tomographic method may offer decided advantages.

The bone changes generally present the following characteristics: more or less irregular reduction in size and zones of decalcification of trabecular aspect with large openings delimited by thinner and often incomplete trabeculae. In the course of time, the roentgen picture becomes worse and pathologic fractures may occur or segments of the rib may become cancellous and even the entire rib may disappear. When several ribs are involved the changes always occur at least partially in the same segment although some ribs may be in a worse condition than others or be more extensively involved. If there is only decalcification, restitution with recalcification is possible in conditions which respond to roentgen therapy.

Sometimes the bone lesions are mistaken for tuberculous processes or primary bone tumors. Also a benign tumor or an aneurysm by pressure on a bone may cause loss of substance and thus be a source of error but the loss will be well delimited and circumscribed and without decalcification at a distance.

The presence of pulmonary tumor may also give rise to remote bone lesions of metastatic type or of another type of which the pathogenesis is not yet clarified but is generally believed to be of toxicodystrophic character i.e. the syndrome of hypertrophy and pneumonic osteopathy of Pierre-Marie.

RICHARD KEMEL, M.D.

On the Pathology and Roentgen Diagnosis of the Apical Cancers and the Malignant Periapical Tumors (Sur la pathologie et le diagnostic radiologique du cancer pical pulmonaire et des tumeurs malignes périapicales). R. MATHY-CORMAY and DR. PIERRE-MARIE. *Acta radiol.*, Stockholm, 1938, 29: 9.

The authors give a brief historical review of apical cancer since the original description by Pancoast in 1904 and the description of the Claude-Bernard-Horner syndrome by the French in 1928. Since this time many other cases have been reported. Especially of interest is the thesis of Tobias. The authors themselves have encountered 92 cases, and their observations are as follows:

Men are affected in from 85 to 90 per cent of the cases and the maximal age incidence is from 40 to 55 years. In women the disease often is found to be a metastatic lesion. The syndrome may be complete or incomplete according to the anatomical organ from which the tumor arises. In order to be complete the pulmonary apex (roentgenological shadow) and the periapical and supra-apical regions (neurological signs) should be invaded. Furthermore, the tumor can be of various histological natures as well as in various sites. Histologically it may be an epithelioma or adenocarcinoma if it has originated from a bronchiole. The periapical tumor may be a pleural endothelioma, sympathoblastoma, thymoma, or branchioma, arising from the embryonal tissues. The metastatic tumors of the apical and supra-apical regions are mostly from carcinomas of the breast, stomach and cervix uteri, from sarcomas, hypernephromas, or teratomas of the testis. Other tumors such as neurinomas and lymphomas and Hodgkin's disease have been reported.

The diagnosis is not always easy especially when the syndrome is incomplete. In the beginning the roentgenological finding may be represented by a very limited homogeneous semilunar shadow. This shadow is homogeneous, leaning against the posterior arch of the first and sometimes of the second rib, continuing medially toward the corresponding articulation between the rib and the transverse process of the vertebra exteriorly to the upper border of the clavicle. It is at this stage that one has to keep in mind the possibility of apical tumor and not to be satisfied with a simple diagnosis of arthritis, apical pleuritis, or neuralgia. The authors state that there were cases considered as apical pleuritis which turned out finally to be malignancies. The tumor is spherical or ovoid in shape surrounded by a zone of atelectasis with sometimes many indentations in the form of crab's paws. However in the majority of cases, the tumor is discovered often after a certain period of involution. It then appears as a mass shadow in the apical area, contiguous to the spine. Tomography should be used to determine the extent of the lesions. High myelography is of help to see whether or not there is involvement of the spine. Bronchography is difficult in the study of this area. In certain rare cases however a bronchogenic tumor has been discovered. Pneumothorax is always difficult to perform because of the presence of pachypleuritis and adhesions.

The authors then describe the special radiological projections they used in the examination of this area. No special scheme is presented concerning the projections used. Biopsy has not been mentioned.

As far as treatment is concerned both surgery and radiotherapy have given poor results. Surgical results may be satisfactory in certain well localized and early diagnosed cases. Radiotherapy has shortened the life of the patient in certain cases. Novocain injection into the brachial plexus is insufficient to stop the pain. Radicotomy or cordotomy must be done.

A few roentgenograms and a brief bibliography are presented.

MARC K. P. SIE, M.D.

**Roentgenological Heart Volume Determination with Special Regard to Pulse Rate and the Position of the Body** HARRY LARSSON and SVEN ROYALD KJELLBERG. *Acta radiol.*, Stockh. 1948 19 159

The authors describe 4 different methods for determination of the heart volume. For practical purposes they use the Rohrer Kahlistorf formula  $V = S_1 \times d \times k$  in which  $S_1$  is the PA surface area of the heart in the lateral view and  $k$  is a factor which was supposed to be constant however the authors showed that it is not constant and varies from case to case with the heart's shape and tilt. When the heart has the appearance of an ellipsoid the volume is calculated as follows  $V = d_1 \times d_2 \times d_3 \times k$ , where  $d_1$  and  $d_2$  are respectively the long and short diameters and  $d_3$  the depth the factor  $k$  must be determined in each case. The authors have shown how this factor is determined. In general a heart which is nearly spherical has a low factor while one which is flatter has a high one.

In order to avoid the volume diminution due to the hydrostatic blood displacement in the standing position the authors make their determinations with the patient in a prone position. The PA and lateral radiographs are taken with the shortest exposure time and this is done through an electrocardiographic apparatus with an attachment coupled to a point-in-relay which gives an exposure at any desired point in the heart cycle. The exposure is performed in maximum diastole just before the R wave since the heart movement is slow and insignificant at this time and the sharpness of the heart image is maximal. However in the investigation of mitral lesions the exposure should be made at the end of systole at the time of the T wave. An electrocardiogram is taken at the same time as the exposure and the pulse rate is obtained. The authors give a simple method of correcting the heart's magnification.

In this investigation it has been established that in the lying position the heart's volume undergoes no demonstrable change with pulse increases up to 120/min. On the other hand in the upright position a diminution in heart's volume proportional to the elevated pulse rate takes place. The pulse rate must rise from about 75 to 80/min before any volume decrease can be observed. The difference in volume between lying and standing positions is not proportional to the difference between the pulse rate in the respective positions but to the difference in the rising pulse rate. In the sitting position a successive decrease in heart size takes place with the progressive rise in the pulse rate by virtue of hydrostatic blood displacement. The greatest decrease was as high as about 16 per cent and occurred with a pulse rate of about 120/min. This value is exactly the same as that obtained by Hodges and Eyster in their investigation. The authors were unable to confirm the large volume difference up to 40 per cent between the lying and upright positions as found by Nelin.

JORGE DE LA FLOE M D

**Experimental Studies on the Motility of the Gastric Mucosa in Dogs.** FRANK P. BROOKS, LLOYD W. STEVENS, EUGENE P. PENDERGRASS, and FRANCISCO BASSOLS. *Am J Roentg* 1948 59 482

The authors have observed the movements of the muscularis mucosae and of the muscularis propria in the living dog by means of roentgenoscopic and roentgenographic studies. The method consisted of suturing six lead shot through the serosa to the greater curvature of the stomach.

Several months previously 7 c.c. of colloidal thorium dioxide had been injected into the submucosa of the anterior wall of the stomach about 10 cm from the pylorus 6 c.c. about 6 cm from the pylorus near the greater curvature 10 c.c. about 3 cm from the pylorus near the greater curvature and about 3 c.c. in the anterior wall of the first portion of the duodenum. Roentgenographic studies showed that the thorotrast had spread out through the stomach wall which permitted a very satisfactory visualization of the mucosal folds of the stomach.

The best results were obtained in the actual study of the stomach by passing a modified Miller Abbott tube into the dog's stomach and inflating the balloon with 30 c.c. of air. The tube was then pulled out as far as possible in order to block off the cardiac opening of the stomach. Fifty cubic centimeters of water were then injected through the tube, followed by 100 c.c. of air and the tube was clamped. Roentgenograms were made at one-half or one-minute intervals. With such a technique definite changes were demonstrated in the form of given mucosal folds during a period in which the position of the shot remained relatively constant. This was interpreted as evidence that the mucosa possesses the ability to move, due to contractions of the muscularis mucosae independently of the muscularis propria. Similar roentgenograms were made after the subcutaneous injection of methohyl which demonstrated movement of both the muscularis propria and the mucosal folds.

The authors conclude that the gastric mucosa is capable of movement due to contraction of the muscularis mucosae independently of the muscularis propria.

FRANK L. HUSKEY M D

**On Roentgenological Diagnosis of Jejunitis Acuta Phlegmonosa** O W. HUSEBYE. *Acta radiol.*, Stockh., 1948, 19 71

The author describes the roentgen recognition of an acute inflammatory process in the jejunum characterized by tissue destruction, abscess formation and possibly gangrene of a segment of bowel. The clinical symptoms may be severe abdominal pain (either general or localized in the epigastrium) vomiting intestinal bleeding and fever. It is thought that some patients recover spontaneously while those whose condition is severe enough to be recognized may require surgery and infectious medical therapy or both. Among 14 cases observed in a 3 year period a tissue diagnosis was made in 6. Five cases are described in some detail. In 2 of these 5

cases operation was done with confirmation of the preoperative roentgen diagnosis by subsequent pathological study of the tissue. Three patients were treated only medically and recovered.

The roentgen findings were stated to be as follows:

1. Reduced diaphragmatic motion on one or both sides.

2. Survey films showed two loops of moderately distended small bowel in the left upper quadrant. The outlines of these loops were roughly serrated and the loops seemed to be somewhat fixed in position and outline.

3. In some cases these loops of gut contained small fluid levels.

4. On barium suspension the involved loops showed a fixed mucous membrane pattern and the fixed position and contour as noted on the survey films was confirmed.

5. The large intestine contained more gas than usual.

6. Passage of the contrast meal through the small bowel was not delayed but the affected loops retained some barium long after the rest of the small intestine was empty.

7. In some cases signs characteristic of peritonitis occurred as complications of the condition developed.

PAUL W. ELLER, M.D.

#### Hysterosalpingograms in Genital Tuberculosis in Women WALDEMA MADSEN *Acta radiol. Stockh.* 947:28:8

The aim of this article is to show which types of roentgenograms are obtained by hysterosalpingography on patients in whom the genital tuberculosis has been verified by laparotomy or endometrial biopsy. It also aims to show that with our present knowledge concerning the interpretation of the roentgenograms obtained by hysterosalpingography has revealed the presence of genital tuberculosis in a number of women whose symptoms were vague and by no means suggestive of tuberculosis. Often the only complaint of the patient was her sterility. In some of the cases ordinary gynecological examination had shown no abnormality.

The author emphasizes that even though there is probably no absolutely specific roentgenographic appearance for tuberculous salpingitis, the following features are strongly indicative of the tuberculous nature of the lesion: (1) when the abdominal ostium is closed, the tube is often considerably less dilated than in other etiological forms of sactosalpingitis (dilated tube with retention of secretions); (2) areas of calcification are sometimes seen in the tube, and (3) calcified glands are sometimes seen in the pelvis.

The observation is made that retention of the contrast medium in tubes which are dilated but slightly or not at all, is highly suggestive of a tuberculous origin of the salpingitis, whereas retention in dilated tubes is the most frequent form of sactosalpingitis when the salpingitis is of gonorrheal or septic origin.

The article includes illustrations and text descriptions of the features encountered in 4 patients

with histologically verified genital tuberculosis (20 patients) or with nonhistologically verified, but otherwise highly probable, genital tuberculosis (22 cases). The author believes that the procedure had been of considerable significance both with regard to the establishment of the presence of an inflammatory process in the genitalia and also with regard to calling attention to the circumstance that the inflammatory process might be tuberculous.

MARILYN W. MILLER, M.D.

#### Further Experiences in the Roentgen Diagnosis of Tuberculous Salpingitis. W. MACGUSMAN. *Acta radiol. Stockh.* 947:28:824.

Hysterosalpingography has acquired increasing importance in the analysis of the causes of female sterility. In spite of the large and widespread experience with this type of examination, it has hitherto been used almost exclusively for investigating the patency of the fallopian tubes and very little interest has been devoted to the study of the roentgenographic appearance of the tubes themselves after different types of salpingitis.

In a previous study of salpingograms in 12 cases of tuberculous salpingitis verified histologically the author found that finely jagged and ragged contours with small lumen defects, and sometimes with abscess and fistula-like extensions of the tubal lumen constituted the roentgenological signs of tuberculosis. The anatomical basis for the changes is probably the swollen and tightly folded mucous membrane.

On the basis of further experiences in 7 new cases and following a re-examination of all cases with tubal occlusion, a second type of salpingographic picture in tuberculous salpingitis is described. It is characterized by straight and rigid contours of the lumen and often by pipelike configuration of the tube. As the result of these examinations it is concluded that a preoperative diagnosis of tuberculous salpingitis is possible in most cases when tuberculosis is the cause.

MARILYN W. MILLER, M.D.

#### On the Technique of Lumbar Pneumomylography OLLE OLSSON. *Acta radiol. Stockh.* 948:50:97

Experience shows that prolapsed discs, especially in the region of the lower lumbar spine, can often be demonstrated only by means of myelography. Both positive and negative contrast media may be used. The author gives a brief review of these media.

The negative media, among which sterile oxygen is the most important, have three disadvantages: (1) the slight contrast, (2) the long time required for the examination, and (3) the ill effects after the examination.

In the present article the author describes a simple technique, aiming to eliminate the three disadvantages. This technique in fact, is a modification of that of Busch and Lindgren. It is as follows:

The lumbar puncture and withdrawal of cerebrospinal fluid are done with the patient lying on a stretcher horizontally on his side. Then one end of the stretcher is lifted, the gas is injected, and the

roentgenograms are taken with the aid of crossed Lysholm grids which are placed upright against the back of the patient. The gas is injected with the Lindgren apparatus a pressure of from 300 to 400 mm of water being maintained. The roentgen rays are directed horizontally. The roentgenograms are made in the straight lateral position as well as with the upper part of the patient's body angulated back at various degrees. The crossed grids mean that two ordinary Lysholm grids are placed at right angles to one another. Such a procedure has the advantage that the irregular structure of the vertebral bodies is replaced to a large extent by a regular network from the grids against which the gas can easily be seen.

The method also permits the visualization of the root pockets and in many instances of the roots themselves. The patients show practically no ill effects because of the swiftness of the examination and the rather low pressure used.

The stretcher procedure is illustrated by photographs and 2 sets of roentgenographic reproductions are included.

T. LEUCUTIA, M.D.

**The Roentgen Picture of Osteoarthritis in the Hip Joint in Cases of Polyarthritidis Rheumatica Chronica.** IVAN HERMONDSON. *Acta radiol* Stockh., 1943, 20 139

The author has studied a number of cases of arthritis of the hip and has attempted to group and classify these according to the various roentgen findings. To fully understand the discussion it would be necessary for the reader to be familiar with the author's previous work on related subjects. The roentgenographic means clearly stated one can by the principal conclusion is clearly stated one can by the roentgenographic means differentially diagnose arthritides of the hip and osteoarthritis when the hip is normally developed. In maldeveloped hip joints this differentiation is not possible.

PAUL W. EYLER, M.D.

**Ossifying Hematomas and Other Simple Lesions Mistaken for Sarcomas.** JAMES F. BRALFORD. *Brit J Rad* 1943, 21 157

Because the author was repeatedly faced with bone lesions the treatment of which had been based on the erroneous findings resulting from biopsy he endeavored what Fung said namely that "the whole clinical and radiographical picture of the case of bone sarcoma usually furnishes a better conception of the diagnostic and therapeutic problem than can be obtained from a biopsy." In the present article the author gives several examples to illustrate this point. In Case 1 a young woman aged 20 the original roentgen diagnosis was that of a chondrosarcoma of the femoral shaft. However a subsequent biopsy revealed negative for evidence of malignancy. Final diagnosis of chondrosarcoma was sustained also histologically and at articulation at the right hip joint.

Case 2 that of a girl 5 years of age represents an osteogenesis imperfecta in which multiple hemorrhages led to large calcified hematomas representing tumors. In particular the shafts of the humeri and femora were enveloped by massive calcareous deposits eventually leading to absorption of the sections of the shafts involved. An erroneous diagnosis of multiple exostoses was made. There was no malignant metaplasia in this case. However to prove the fact that such ossifying hematomas can be interpreted as sarcomas on clinical histological and radiographic evidence the author cites 2 other cases.

In Case 3 that of a child 3 months old a diagnosis of osteogenic sarcoma of the femoral shaft was made but subsequent roentgen studies established the presence of an ossifying hematoma which later absorbed the femur becoming of normal appearance. The other case which is not described in the text was that of a surgeon's little daughter. The nurse discovered on the child's arm a mass associated with a bone which was tender on pressure. Originally a thorough roentgen study the benign nature of the lesion was established and no amputation was performed.

Additional samples of ossifying hematomas are the large hemorrhages which occur in limbs in which the nerve supply has been damaged in hemophilia. Charcot's joint spina bifida apparently without any known trauma congenital syphilis intramedullary infarcts of caisson workers and the so-called osteoid osteoma. A differentiation in all these instances from a possible malignant tumor of the bone is very important.

The author includes many roentgenographic reproductions for the purpose of illustration some of which are quite unusual.

T. LEUCUTIA, M.D.

**Practical Aspects of the Diagnosis, Treatment and Prognosis of Hodgkin's Disease and Allied Disorders.** HENRY JACKSON JR. *Radiology* 1943 50 481

The author divides Hodgkin's disease into 3 types the comparatively benign paraneoplasia the more frequent and more fatal granuloma and the rare but extremely malignant sarcomatous type. Lymphosarcoma and reticulum cell sarcoma are also discussed.

The author states that Hodgkin's granuloma is encountered most often and he believes that for about every 250 cases of Hodgkin's granuloma there will be 100 cases of reticulum cell sarcoma 60 cases of lymphosarcoma and perhaps 50 cases each of Hodgkin's paraneoplasia and Hodgkin's sarcoma. Symptoms are discussed briefly and the protean character of the symptomatology is pointed out. The therapeutic approach to the various types of Hodgkin's disease is different. In the authors opinion Hodgkin's paraneoplasia if sharply localized to one area should be excised and thereafter moderate doses of radiation given in the involved area. If it is generalized moderate doses of roentgen irradiation

radiation are considered sufficient. Likewise, in Hodgkin's granuloma if the disease is sharply circumscribed and accessible and there are no general symptoms such as fever or anemia, the author advises radical excision followed by irradiation. If it is generalized when first seen as this type usually is, the author administers only moderate amounts of roentgen irradiation to the involved areas. Heavy doses are not advocated, but it is suggested that therapy be continued until it is clear that further treatment can do no good.

If Hodgkin's sarcoma, the author recommends that the best treatment is to keep the patient comfortable. In cases of lymphosarcoma, if it is localized as rarely is, excision may give a good result. If it is inoperable radiation is all that is offered. If reticulum cell sarcoma is localized and accessible, the author believes that excision should be done. If the disease is localized but not operable heavy irradiation is recommended if it is generalized sufficient roentgen irradiation to alleviate symptoms is all that is indicated. *Brown and C. Ruyter, M.D.*

#### Experimental Studies on the Toxicity of Priodax. John Howard. *Am. J. Roentg.* 94:3, 59-608.

Tetralodophenolphthalein a drug widely used in cholecystography is excreted largely by the liver and partly by the kidneys. Dick and Wallace in 1928 experimentally studied its effect on the pancreas and they arrived at the conclusion that there is risk of damage to the pancreas in jaundiced patients who are afflicted with chronic obstructive lesions of the biliary tract. This explains why tetralodophenolphthalein is not used for cholecystography in the presence of obstruction to the extrahepatic biliary tract or in suspected pancreatitis.

In 1940 priodax, which contains 51.5 per cent iodine by weight, was introduced and since then has found extensive clinical application.

The author in a series of experiments performed on cats and dogs, determined the effects of the priodax on pancreatic tissue.

*The effects of priodax on the pancreas under normal conditions.* Four normal dogs and 2 normal cats were used. The priodax was given by mouth in doses of from 400 to 500 mgm. per kilogram of body weight to dogs, and of approximately 250 mgm. per kilogram of body weight to cats. After 24 hours a laparotomy was done the pancreas was studied grossly and in 3 days also microscopically and the iodine concentration in the gall bladder bile was determined. No damage was noted.

The effects were also studied clinically on 9 normal patients by means of serum amylase determinations. A dose of 3.0 grams of priodax was given orally. The gall bladder was visualized roentgenographically in each instance. There was no pancreatic damage.

*The effects of priodax on the pancreas in case of obstructive disease of the common bile duct.* For this experiment 6 dogs and 2 cats were used. Under sterile conditions the common bile duct was doubly ligated and 18 hours later a second laparotomy was done. 7 days

after the administration of the drug. The pancreas was examined grossly and histologically and the iodine concentration of the bile aspirated from the gall bladder was determined. Four of the dogs were sacrificed on the seventh day and the pancreas was re-examined. Except for two minor changes incidental to technique, the pancreas appeared normal.

*The effects of priodax suspended in physiological saline solution when injected into the pancreatic duct.* Seven dogs and 4 cats were used. The major pancreatic duct was exposed by blunt dissection and ligated at its entrance into the duodenum. In the dogs from 0.8 to 4.3 mgm. of priodax, and in the cats from 0.6 to 0.75 mgm. of the dye (a suspension of 500 mgm. of priodax in 100 c.c. of physiological saline solution) was injected into the pancreatic duct. Of the 7 dogs, only one showed evidence of injury consisting of fat necrosis with death. The pancreas of the cats showed a slight localized edema or fat necrosis at the site of the ligation. A similar change however was observed also in control animals in which only physiological saline solution was injected into the main pancreatic duct.

*Injection of gall bladder bile contains no priodax into the pancreatic ducts.* In this additional experiment 4 dogs and 3 cats were used. The dogs were given 3 grams of the priodax orally. After 24 hours bile was withdrawn from the gall bladder and 1 c.c. was injected slowly into the pancreatic duct as in the previous experiments. Biopsy of the pancreas was then done from 24 to 72 hours later. In the cats 500 mgm. of priodax were given orally and 24 hours later 0.5 c.c. of gall bladder bile was injected into the pancreatic duct. In practically every case marked injury of the pancreas developed consisting of exudate, edema, and fat necrosis. In a control group of animals in which 0.5 c.c. of bile without priodax was injected into the pancreatic duct the same widespread changes occurred.

The results of these experiments indicate that in unobstructed biliary tracts no damage to the pancreatic tissue is produced by the priodax. Likewise there was no evidence that in the presence of acute extrahepatic biliary obstruction injury is attributable to the priodax. Bile injected into a pancreatic duct of the dog produced such injury to the pancreas that the added effect of the dye in the bile if any could not be properly evaluated. *T. LECOTTE, M.D.*

**Morphologic and Functional Damage in the Region of the Extremities as a Result of Previous Arteriography with Thorotrast** (Morphologische und funktionelle Schädigungen im Bereich der Extremitäten als Folgen vorangegangener Arteriographie mit Thorotrast) OTTO STAMM. *Heid. chir. wch.* 94:7, 4-490.

A description of the pathologic findings in 4 cases of obliterating arteritis in which arteriography of the lower extremities had been carried out with thorotrast is presented. There were 3 cases of arteriosclerosis and one case of Buerger's disease. Observations were based on local and microscopic studies, on

roentgenograms and general postmortem findings. It is generally assumed that the intravenous injection of a maximum of 20 c.c. of thorotrast is followed by a rapid thinning and dilution of the material and an insignificant diffuse storage in the reticuloendothelial system after passage through the first capillary bed.

The author states that these assumptions are false. In the reported cases of obliterating arteritis, numerous thorotrast emboli were observed in the arterioles and capillaries and in the surrounding connective and fat tissues. Degenerative changes in the vessel walls involving the endothelium, media, and adventitia with perivascular hemorrhagic edema and ischemic necrosis were observed. These changes are attributed to local anoxemia resulting from embolic obliteration and injury to the vessels rather than to any physical or chemical reaction to the thorium. There was also evidence that the damaged vessel walls permitted the oozing through of quantities of thorotrast in the first capillary net to establish thorotrast depots. The extravascular thorotrast is removed only to a slight extent by the lymph and remains to cause constricting scar tissue formation and later damage to the vessels and nerves. In 2 cases a fatal, toxic anemia followed the injection of thorotrast. The clinical course resembled that described for the crush syndrome and was attributed to the occurrence of muscle ischemia following the injection of thorotrast.

The use of thorotrast for arteriography is condemned as too dangerous especially since new, molecularly dissolved radiopaque substances which appear to be harmless are available.

JOHN L. LINDQUIST, M.D.

**The Presentation and Analysis of the Results of Radiotherapy** J. W. BOAG, *Brit J Radiol* 1948, 21: 188.

Analysis of the results of radiotherapy in the treatment of carcinoma has never been entirely acceptable to those concerned with cancer treatment. Many difficulties are encountered viz., death of the patient as a result of intercurrent disease, small group of cases and incomplete use of history and information.

A method has been devised whereby full advantage may be taken of all patient information. This is especially important in attempting to evaluate the results in a recently treated patient, or in one who was treated many years ago or who died of intercurrent disease.

A dot diagram method was used wherein each dot represents a patient. Four forms of dots were used to indicate whether the patient died with cancer or from intercurrent disease or whether the patient is alive and symptom free or alive but with evidence of cancer. The position of the dot on the time scale indicates the time that elapsed between the beginning of treatment until death of the patient or until the analysis was made. The dots can be made to render information such as whether the

patient died with the disease in the primary site or in metastatic glands. Care should be taken to avoid making the chart top-heavy with different types of dots.

Many instructive graphs (a series of carcinoma of the tonsil and mouth) are shown to illustrate how to obtain the most of the best instructive data from any given series of cancer patients.

MAURICE D. SACHS, M.D.

**Histologic Changes in Squamous-Cell Carcinoma of the Mouth and Oropharynx Produced by Fractionated External Roentgen Irradiation** JOHN W. HALL and MILTON FRIEDMAN, *Radiology* 1948, 50: 318.

The authors studied the histologic effects of fractionated roentgen irradiation as used in the modern radiotherapeutic technique. The administration of roentgen rays in small daily fractions permits the normal epithelium to recover somewhat each day from the irradiation injury, but the less differentiated tumor cells for the most part show no evidence of recovery. Fractionation also increases the number of times each tumor cell is exposed to irradiation while in the premitotic or mitotic phase which is believed by many to be the most radiosensitive phase.

The material studied was obtained from 28 patients with squamous-cell carcinoma of the mouth and oropharynx who were subjected to periodic biopsies during treatment. Two techniques were used. Twenty-four of the patients were given a standard technique which consisted of the administration of a daily skin dose of 400 roentgens (with back scatter) to provide an approximate average daily tumor dose of 175. The total tumor dose averaged approximately 6,000 roentgens to 6,500 roentgens in from 23 to 28 days. Four patients were given one half of the daily dose of the standard technique which consisted of 200 roentgens (measured with back scatter) to provide approximately 135 roentgens daily to the tumor over a period approximately twice the length of time to approximate the dosage of the standard technique. The physical factors were 300 kv, 0.5 mm or 2.0 mm of copper filter, 20 ma, 50 cm. target-skin distance usually with a 10 by 15 portal, half value layer of 0.9 or 1.8 mm of copper, and a dosage rate of from 10 to 40 roentgens per minute. The biopsy material consisted of 140 specimens from 28 patients. Each patient except one had a pretreatment biopsy.

The histological changes produced in the tumor cells following irradiation of squamous-cell carcinoma were of the following major types: acute cell death, progressive enlargement of the cells to giant-sized tumor cells, and radiation keratogenesis. Various combinations of changes were noted in a single tumor undergoing destruction by radiation.

Acute cell death is the most common change. It affects the cytoplasm, nucleus and other components of a cell impartially and is usually seen in the first 7 days. This is the process whereby the most radio-

sensitive cells are destroyed. Its importance has not been sufficiently emphasized.

The less sensitive cells, not undergoing acute cell death, show progressive enlargement to giant-sized tumor cells. This is the result of two different mechanisms (1) swelling and vacuolation of the cytoplasm and to a lesser extent of the nucleus, probably through a physicochemical disturbance of the intercellular and intracellular exchange of fluids and (2) disruption of the nuclear function resulting in the formation of various nuclear abnormalities.

Radiation keratogenesis, another mechanism of cell destruction, is the acceleration either in time or degree of the normal process of keratinization. It is a cytoplasmic phenomenon.

Under-irradiation of a tumor (chiefly in the form of an inefficiently small daily dose) produces some destruction of tumor cells, but chiefly provokes maturation of the more radioresistant cells.

The most pronounced change in the stroma is replacement fibrosis secondary to and in proportion to radiation destruction of tumor. Irradiation also increases hyalinization of the connective-tissue stroma, and to a slight extent produces degenerative changes within some fibroblasts, namely swelling and vacuolation.

With fractionated irradiation damage to the blood vessels is usually slight and occasionally moderate in degree.

A single biopsy taken between the seventh and eleventh days during a course of fractionated irradiation will yield considerable information concerning the radioresensitivity of the tumor and the effectiveness of the irradiation technique.

FRANK L. HURLEY, M.D.

**An Anatomic Classification of Cancer of the Larynx for Use in Radiation Therapy** EDWARD L. JENKINSON and EVERETT L. PIRKEY *Am J Roent* 94:5, 59.

A new anatomic classification of laryngeal carcinoma is offered for use by radiologists. The authors believe that while the anatomic classification of intrinsic and extrinsic lesions is all-important to the laryngologist it is relatively unimportant to the radiologist since it is the extent, rather than the location of the lesion which is important in determining the prognosis. Intrinsic and extrinsic terminology is still used primarily for the benefit of the laryngologist. Lesions are classified according to stages, i.e. stage 1 is the involvement of any one area whether it be true or false cords stage 2 is the involvement of any two adjacent areas stage 3 is the involvement of any two nonadjacent areas or any three adjacent areas and stage 4 is the involvement of more than three areas, the regional glands or distant metastasis. Before classifying the stage of the disease it is desirable to obtain biopsy by means of direct laryngoscopy as well as soft tissue films of the neck.

On the basis of the above classification, 58 patients were treated from 1936 to 1945. Of this number 4 were treated only once or twice and therefore are

not included in this statistical survey. Nine other cases were not adequately followed up so they too are not included. Therefore 45 cases are analyzed for statistical purposes.

The disease occurred mostly in the third decade of life. The over-all occurrence as to stages was as follows: stage 1, 5 cases; intrinsic, and 4, extrinsic. In this group 5 of the patients in the intrinsic group survived for 61.4 months, and 3 in the extrinsic group had an average survival of 45.3 months. Stage 2: 1 case intrinsic, none alive; 1 case extrinsic with a survival rate of 28 months. Stage 3: 5 cases, intrinsic, with 26.2 months average survival; 4 patients alive; 2 cases, extrinsic, none alive with an average survival of 26 months. Stage 4: 6 cases, intrinsic, 2 alive with an average survival of 17.5 months; 2 cases, extrinsic, with an average survival of 13.1 months; 6 patients alive. The over-all average of all these cases was as follows: intrinsic group — 17 patients with an average survival of 34.6 months; 11 alive; extrinsic group — 28 patients with an average survival of 8.3 months; 10 alive.

Ten patients had to have tracheotomies while under observation; 6 of them before treatment and 4 after treatment was started. A gastrostomy was required in 3 other patients. A laryngectomy was required in 2 patients before treatment and in 2 after treatment. The latter 2 were operated on for probable local recurrence. Two patients had laryngeal fistulae followed by recurrence for a short period, for which radiation was administered.

Technical factors consisted of 200 kv, 20 milliamperes, filter 50 cm, target skin distance 10 cm, use field, directed to the larynx, a daily dose of 200 roentgens measured in air, total dose of 3,800 roentgens; each field the tumor dose being estimated at 7,752 roentgens. There was no evidence of radiation necrosis in the entire series. Marked skin reaction was noted but this cleared quickly at the conclusion of the series of treatments. Edema of the laryngeal mucosa sometimes persisted for several months to years, but no permanent damage was observed.

The authors were impressed with the fact that they obtained excellent results by treating lesions found early in the stage of the disease. A better prognostic value is obtainable by use of this new classification as to stages of the disease.

MAURICE D. SACHS, M.D.

**The Use of High Voltage Roentgen Therapy in the Treatment of Amenorrhea and Sterility in Women.** I. I. KAPLAN *Am J Roent* 94:5, 59-570.

Amenorrhea may be due to numerous and varied conditions. In some cases it is due to congenital or pathological malformations. For these irradiation is of no avail. Irradiation is useful in those cases in which the amenorrhea is a result of physiological dysfunction.

The reason for the efficacy of irradiation in the treatment of amenorrhea and sterility is still not definitely known. Several hypotheses are mentioned,

and case histories fitting each of these are presented (1) the selective action of roentgen rays upon ovaries (2) stimulation of an undeveloped uterus, (3) mechanical alteration of tissues due to swelling and hyperemia (4) roentgen destruction of mature unruptured follicles.

Pituitary irradiation was also used. The reason for its beneficial effect is unknown.

The present study comprises a review of 338 cases. Only 334 of the patients were fully treated. Of these 33 were unmarried and 301 were married. Of the 274 cases followed favorable results were achieved in 12 unmarried and in 198 married women in 9 unmarried women and in 55 married women the treatment failed. Following irradiation 90 patients had normal full term pregnancies.

All patients were referred by gynecologists after all medical and hormonal therapy had failed. The period of sterility varied from several months to several years.

The factors used were 200 kilovolts, 4 to 5 milliamperes with 0.5 mm. of copper plus 1 mm. of aluminum filter with a skin target distance of 30 to 40 cm in early cases but 50 cm in all patients treated in the past 10 years. On the first day 50 roentgens of radiation were administered to the anterior left and right ovarian fields and 75 roentgens to the anterior pituitary region. One week later, 75 roentgens were given to the posterior left and right ovarian fields. The third week, 50 roentgens were given to the anterior left and right ovarian fields and 75 roentgens to the anterior pituitary region. The dose into the ovaries must be between 10 and 14 per cent of the given dose measured in air.

The author believes that the irradiation outlined—properly administered—will harm neither the mother nor the offspring. JOSEPH P. TOMSULA, M.D.

**External Irradiation with Roentgen Rays and Radium in the Treatment of Human Leucemias, Lymphomas, and Allied Disorders of the Hemopoietic System.** ANNA HAMANN. *Radiology* 1948 50: 378.

The author reviews 337 cases which represent the number of patients who were treated by irradiation from 1929 to 1945. The series consists of patients with leucemia, Hodgkin's disease, lymphosarcoma, and polycythemia rubra vera. In all cases of Hodgkin's disease and lymphosarcoma the diagnosis is verified by biopsy. In 33 per cent of leucemias, confirmation was obtained by bone marrow aspiration or biopsy lymph node biopsy or at autopsy. The routine treatment in all four groups of disease was roentgen therapy given as local irradiation. Supplementary therapy was used which consisted of total body or wide field spray irradiation, radium therapy and chemical agents. The chemicals were Fowler's solution in myelogenous leucemia, radioactive phosphorus in polycythemia rubra, and nitrogen mustards in selected cases of all groups.

The roentgen ray quality used was high value layer 1.5 mm. copper (200 kv.) 1.0 mm. Cu plus 1.0

mm. aluminum filter. On skin lesions and small superficial nodes the high value layer 0.24 mm. Cu (135 kv.) 3.0 mm. aluminum equivalent intrinsic filtration only) was used.

In all patients with generalized disease the minimum doses necessary to produce a remission were given. Treatment courses were repeated only in the presence of symptoms and signs indicating activity of the disease—not prophylactically. In localized single manifestations of Hodgkin's disease and lymphosarcoma, high total doses of 5,000 to 4,000 roentgens were given. Total body or wide field spray irradiation was given chiefly to patients in advanced stages of the disease. The radiation quality in these treatments was high value layer 1.5 mm. copper. The maximum dose applied in advanced stages of Hodgkin's disease and lymphosarcoma was 200 roentgens D<sub>0</sub> to the anterior and to the posterior surfaces of the total body. Nitrogen mustard and radiophosphorus were used as adjunct treatments.

Six of the 49 patients with chronic myelogenous leucemia and 8 of the 51 patients with chronic lymphatic leucemia lived over 5 years. Seven of 143 patients with Hodgkin's disease lived over 10 years and 26 lived over 5 years. Three patients with lymphosarcoma lived more than 5 years. 2 without evidence of disease. In polycythemia rubra vera the results of roentgen therapy were not gratifying. The dosage required for effective roentgen therapy in this condition is high and does not allow frequent repeat courses. The roentgen therapy of leucemia, Hodgkin's disease, and lymphosarcoma judiciously given with the present methods is an effective palliative measure with a great margin of safety and few complications. The efficacy of total body irradiation is less clear. Supportive treatment with arsenicals is of real value in myelogenous leucemia.

FRANK L. HUSKEY, M.D.

**An Experimental Clinical Series in the X Ray Treatment of Epitheliomas.** J. VAN ROOZEN. *Clin. Proc. Cape Town*, 1947 6 Supp.

The author reports on the results he has obtained with x ray therapy in 30 cases of epithelioma of various parts of the body (including the cheek, lip, nose, tongue, floor of the mouth, cervix, larynx, pharynx, and base of the tongue) by employing a 12 hour interval instead of the usual 24 hour or longer interval between treatments.

This experiment in this series of cases was based on the results of the experimental work of Reissner, Quimby and McCoomb. Reissner showed that small or doses given closer together caused less reaction of the normal skin than larger doses spaced further apart when the total dose and the time to administer the total dose were the same. Quimby and McCoomb showed that a greater measure of recovery from the effects of irradiation occurred during the first 6 to 12 hours after exposure than during the next 12 hours.

The beneficial effects from irradiation of a tumor depend on the sterilizing effects upon the tumor cells



and the recovery of the surrounding stroma to normality. Recurrence is more likely if the surrounding stroma has been irreparably damaged or destroyed. Irradiation of an epithelioma causes a speeding up of the process of keratinization and fragmentation of cells leading to gradual shriveling of the tumor and tops. It delays mitosis which restores the normal balance between maturation and the new formation of cells.

The author found that by using a field of 150 sq cm. and radiation with a high value layer of 1.35 mm. of copper it required between 2,400 and 2,600 roentgens, given in eleven equal exposures at 12 hour intervals to produce the same erythema as is produced by from 1,800 to 2,000 roentgens given in six equal exposures at 24 hour intervals. Also he found that a total dose of from 2,600 to 3,400 roentgens could be given in eleven equal treatments every 12 hours with little or no resulting erythema. After the first few cases in his series, he found that a total dose of 2,400 roentgens given in eleven equal treatments every 12 hours was the optimum dose and would cause complete regression of the local epithelioma. Tumor growth in most of the cases without a marked skin erythema or damage to the surrounding stroma. He did not state whether the dosage represents roentgens in air or on the skin. In the treatment of carcinoma of the cervix it was intended to be tumor tissue roentgens and these were given through anterior and posterior pelvic and perineal

portals. This same x ray dosage produced similar results to those of 4,000 and 5,000 gamma roentgens of radium. The author regards a gamma ray dose of 4,000 roentgens over 5 days as adequate in the treatment of epitheliomas and a dose of more than 5,000 gamma roentgens as undesirable, because of the damage to the stroma.

With the stated x ray dosage for carcinoma of the cervix no radiation sickness occurred. The total body ionization was calculated to be between 10 and 12 mega gram-roentgens. Erythema will appear with smaller doses if the tissues have been irradiated previously.

Many excellent and impressive photographs are shown of patients who had been treated by this means. Because of the short time of his observation of these cases, the author does not claim to have cured any of the patients but he believes that the good results will prove to be permanent in half of the cases.

The advantages of this method of treatment are:

1. The course of treatments is finished in one week.

Epitheliomas of the skin and mucous membranes can be made to disappear with quantities of irradiation less than those required to produce an erythema of the skin or destruction of normal structures.

3. Radiation sickness rarely if ever occurs.

Vern W. Ritter, M.D.

# MISCELLANEOUS

## CLINICAL ENTITIES—GENERAL PHYSIOLOGICAL CONDITIONS

**Late Reactions to Metallic Foreign Bodies.** THOMAS W. BOTTORF and D. RICHARD FRENT. *N. England J. M.* 1948, 338 385

The authors present their observations on a group of 40 male veterans with metallic foreign bodies who have undergone treatment at the Veterans Administration Hospital in West Roxbury, Massachusetts. It is known that when unabsorbable foreign bodies are imbedded in soft tissues they become surrounded by a fibrous capsule. In the presence of pathogenic and uninhibited bacteria, an abscess and a chronically discharging sinus tract may be formed. This reaction may be immediate or delayed, and its severity will depend on the virulence of the offending micro-organism. Foreign bodies may remain encysted for many years without causing symptoms. Bizarre migrations of foreign bodies especially of sharp pointed objects occur.

The patients were grouped in the following 3 classes: those with (1) multiple regional foreign bodies with cellulitis, (2) single or multiple foreign bodies with abscess formation, (3) a single foreign body without infection but with pain. Penicillin was administered to patients with signs of infection beginning the day before operation. A booster dose of tetanus toxoid was administered in all cases. The foreign body was removed along with the entire fibrous capsule and the excised specimens were examined histologically. Anaerobic and aerobic cultures of the foreign body were made in the operating room.

The basic principles of surgery for the removal of foreign bodies are accurate localization and control of infection. The authors controlled infected wounds as well as the actually septic wounds with the aid of antibiotics, sulfonamides and tetanus immunization. They successfully utilized the Berman foreign body locator as it accurately localized the foreign bodies and facilitated surgical procedures. With the aid of this locator the time required for the search for foreign bodies was also greatly shortened, and considerable trauma was avoided.

ROBERT TURNELL, M.D.

**The Dynamics of Protein Metabolism. I. The Interrelationship between Protein and Caloric Intake and Their Influence upon the Utilization of Ingested Protein for Tissue Synthesis by the Adult Protein Depleted Rat.** EARL P. BENNETT, ELEANOR M. HUNFORD, ROBERT W. WISLER, HAROLD STEFFER, and OTHERS. *J. Lab. Clin. M.* 1948 33 357

To determine the relationship between the caloric intake and the utilization of proteins in the body

studies were carried out on rats which had for 2 months been carried on a diet which was adequate in all essentials except protein. At the end of the depletion period they were isolated into groups and fed definite diets. After 14 days of such diets the animals were sacrificed and the carcasses were divided into the various organs and other parts of the body which were then analyzed for their content of fat, water, protein and water soluble contents.

From these experiments the following observations were made: restriction of the caloric intake below a certain level restricts the utilization of ingested protein for the fabrication of tissue. The increase of the caloric intake above the critical level however does not augment the rate of utilization of a given quantity of protein above the maximum. Furthermore the critical level appears to be 1240 calories per square meter per day and constitutes the energy necessary to cover the needs of maintenance storage, tissue synthesis and waste. Increasing the caloric level above the critical level results in an increase in the body weight largely by deposition of fat. With the caloric intake adequate, the utilization of protein is a function of the level of intake, utilization rising with increasing intake.

WILLIAM C. BECK, M.D.

**The Dynamics of Protein Metabolism. II. The Relationship between the Level of Protein Intake and the Rate of Protein Utilization by Protein Depleted Men and Rats.** EARL P. BENNETT, ROBERT L. WOOLDRIDGE, and ROBERT STEPTO. *J. Lab. Clin. M.* 1948 33 369

The authors assumed that the basic mechanisms for protein synthesis were the same for all mammalian species and tried to utilize a common denominator for comparison between man and animal in the utilization of protein. The basal metabolic unit being the calory per square meter of surface per time unit seemed to be such a factor. Comparable experiments demonstrated that both in man and rat both depleted of protein there was a striking resemblance in performance. In both the protein utilization paralleled the protein intake given an adequate caloric intake.

The basic energy requirements of animals varying in size from the mouse to the elephant have been found to be proportional to a function of the body mass which approximates mathematically the surface area. In a broad viewpoint therefore there is a general quantitative as well as qualitative pattern into which rats as well as man fit.

From these studies, the authors feel that the calory intake in problems of nutrition has been overdrawn that while heat may be a necessary product of tissue activity it is after all a by-product that while a basic caloric requirement (which they estimate at 3600 calories per day) for the afebrile man at bed

rest is necessary a protein of high biologic value must be fed this must also be fed in excess of the quantity needed for nitrogenous equilibrium and, in general the higher the level of protein intake, the greater the rate of synthesis, if other elements of essential dietary are adequate

It is believed that in figuring the caloric intake the proteins should not be included. In comparing the rat and the man, it is impossible to feed the man as much protein as the rat because of the relatively large surface mass ratio in the latter. Nevertheless, the data indicate that man can utilize up to 4 gm. of protein per kilogram per day. In order to obtain good rates of tissue synthesis, diets should contain between 1 to 4 gm. of protein per kilogram per day. Such intakes would assure a greater absolute rate of protein storage and a higher gross efficiency of protein utilization

WILLIAM C. BECK, M.D.

**Procaine Penicillin G in Oil. Plasma Concentrations: Preliminary Observations on Its Use in Pneumonia.** WILLIAM P. BOGER, JACQ E ORITT, HAROLD L. ISRAEL, and HARRISON F. FLEPPEN. *Am J M Sc* 94B, 5, 50.

Procaine penicillin G is a combination of equimolar quantities of penicillin G and procaine base to form a crystalline salt which is relatively insoluble in water (less than 0.7 per cent at 37°C.) Because of its low solubility a slowed release of penicillin into the circulation occurs after intramuscular injection of the substance a phenomenon that is in effect (but not cause) similar to that of the penicillin in oil and beeswax formula of Romanovsky in which the prolonged penicillin effect (delayed absorption) is achieved by the oil and beeswax milieu. Allergic reactions, sterile abscesses, and severe pain at the site of injection have occurred sufficiently frequently with the oil and wax preparation so as to prejudice many physicians against its use hence the search for a substitute such as procaine penicillin which is wax-free.

Utilizing procaine penicillin G in a sesame oil suspension containing from 300,000 to 600,000 units of penicillin per injection, the authors observed no local pain or systemic toxicity in 50 patients. Plasma concentrations of penicillin above 0.039 units per cubic centimeter after a single injection of 300,000 units of procaine penicillin varied from 6 to 30 hours in a group of ambulatory control patients, and from 7 to 70 hours in a group of 10 pneumonia patients with an average for the two groups of 13 and 33 hours respectively. Eighteen of 23 patients suffering from bacterial pneumonia recovered without complication following a single intramuscular dose of from 300,000 to 600,000 units of procaine penicillin G in oil. Two patients relapsed under this treatment and 3 failed to respond. The authors conclude that a single injection of 300,000 units of procaine penicillin G in oil will, in the average patient, give a satisfactory plasma concentration of penicillin, or a suppressive antibacterial action for at least 4 hours.

W. WYLLIE CAMERON, M.D.

**The Origin of Edema in Anemia (Ueber die Entstehung anämischer Oedeme).** MICHAEL FÖLDI, AX DREAS KOROSYI, and GEORGE SZABO. *Id med scand* 94B, 39, 486.

An investigation of the role of capillary permeability in the development of edema in patients with anemia was carried out. The method of Landis was used this consists of constricting the upper arm for 30 minutes with a pressure of 40 mm. of mercury and at the end of this period determining the hematocrit value and the albumin concentration of the venous blood. Venous blood from the unconstricted arm being examined for comparison. From these values one can calculate the fluid mass (per 100 c.c. of blood) that leaves the vessels. The albumin concentration of the extravasated fluid and the colloid osmotic pressure were also determined.

In the majority of patients with anemia a significantly increased capillary permeability was detected, and the filtered fluid contained more or less albumin. Under normal circumstances the fluid which filters through the vascular walls is albumin free. There was no correlation between the colloid pressure and the filtration but there was a correlation between the hemoglobin concentration and the filtration.

From these experiments it appears that the chief cause of water retention in anemia is increased permeability of the capillary endothelium. There is a close relationship between the increased permeability and the degree of diminution of hemoglobin concentration.

JOHN L. LINGGREN, M.D.

**Experimental Investigations on the Anesthetic Infiltration of the Sinoglandocarotid Zone as a Treatment of Traumatic Shock (Idagali sperimentali sulla infiltrazione anestetica della zona seno-glioma-carotidea quale terapia dello shock).** NICOLA DEL BELLO. *Ann. del chir.* 947, 24, 550.

The carotid sinus, a dilatation of the internal carotid artery constitutes together with the carotid gland the so-called sinoglandocarotid zone. This zone is very sensitive to variations in pressure regulates the cardiac frequency and arterial pressure and also influences the respiratory rhythm. It also has the action of establishing equilibrium on the endocranial circulation. According to the latest research, the nervous endings in the carotid sinus perceive the pressure variations, whereas the chemical excitants affect the carotid gland.

The beneficial results following the anesthetic infiltration of the carotid sinus as a treatment for shock have recently been reported. These have been reported following clinical applications. The author decided to conduct animal experiments in order to explain these results. In man the zone is infiltrated by inserting the needle along the anterior margin of the sternocleidomastoid muscle at the level of the superior margin of the thyroid cartilage with the neck in hyperextension. In the dog, however the zone is more difficult to find and the author resorted to exposing it and ligating it so that he could bring

it externally when he wanted to inject it and in this way be positive of the area he was injecting.

The beneficial effects produced are explained according to the idea of Leger who believes that the anesthetic infiltration of the carotid sinus acts in shock by causing a discharge of corticoadrenal hormone and that this improves the capillary atony and arterial hypotension. The author would like to add that among the various causes for shock the vagosympathetic imbalance plays some part also that of the peneurotomy infiltration will cause an improvement of the cerebral circulation. The infiltration is believed to correct the nervous imbalance.

The author reviews the literature on shock and makes numerous references to the works of Blalock, Phemister, Cannon, Moon, Allen, Rosenthal, Harlins and other American authors.

LUCIAN J. FROMDOTT, M.D.

**Observations of Burn Scars Sustained by Atomic Bomb Survivors. A Preliminary Study.** Mizushima A., Block and MABAO TOSUKU. *Am J Surg* 1948, 75: 477

Many of the burns sustained by atomic bomb survivors have healed with accumulations of excessive amounts of elevated scar tissue, many having the gross appearance of severe scar keloids. An observational study was made on survivors at Hiroshima and Nagasaki as well as on patients in Tokyo hospitals who had been burned from other causes than the atomic bomb explosion.

The burns seen in 1945 after the atomic bomb explosion were largely flash burns, the result of radiant heat emitted at the time of the explosions and thus they were limited to exposed areas of the skin or to places where overlying clothing was in intimate contact with the skin. All degrees of severity of burns of first or second degree these usually healed within 4 weeks. However, nearly all burns of second degree or worse became infected and their healing was usually delayed. Treatment of the burns was limited largely to local applications and dressings; relatively few patients received transfusions and early skin grafting was not done.

The keloids and hypertrophic scars continued, in general to increase for a few months after their presence was first noticed. Their surfaces were smooth and shiny but wrinkling of the surfaces appeared after about a year which indicated contraction. Some scars decreased slightly since the spring of 1946 but large numbers of contractures occurred at locations where these usually develop. The areas of scar keloid as now seen typically occupy the central part of the burned area where the burn was most severe and where it healed last. Areas involved vary from a few centimeters in diameter to almost complete coverage of the back or forearm.

A major problem in the study was the determination of the exact nature of a scar keloid. It was not possible from clinical observations and histologic studies of excised scar tissue to arrive at a definition

that would separate keloids from hypertrophic scars. It would seem that keloids and hypertrophic scars differ only in the degree of accumulation of scar tissue after healing of the surface of the lesion.

In this study, 90 patients who were survivors of the atomic bomb explosions were studied along with 25 Japanese patients who received burns from causes other than the atomic bomb. Of the 90 bomb survivors 49, or 54 per cent, developed scar keloids of varying degrees. Of the 25 patients burned from other causes, 10 developed scar keloids.

It was believed that plastic surgery had been done on too few of the patients to warrant conclusions regarding the frequency of recurrence of keloids and occurrence of keloids in donor sites for skin grafts. Three of 10 patients who had received grafts following removal of keloids showed recurrence of keloids and 3 others developed hypertrophic scars in the grafted areas. These recurrences were usually located where the grafts had apparently not taken well. Four of 8 patients developed keloids along the lines of closure following excision of the keloids with primary closure.

In regard to the incidence of keloid formation among the Japanese the best available evidence indicates that perhaps they have a slightly greater tendency toward keloid formation than the white race but not so great a tendency as the Negro race.

In general the data indicate that the keloids produced represent no peculiar effect of the atomic bomb explosion since similar keloids were found in other Japanese sustaining ordinary thermal burns. In addition it seems probable that a similar incidence of keloids could have occurred in burns of the same severity from any other cause under similar conditions during the healing of the lesions in patients having the same general state of health.

FRANK F. KANTHAKE, M.D.  
Plasma Cell Tumors. G. LUKS and T. M. PROSSER  
*J. Bone Surg.* 1948, 30B: 125

The authors review the historical data and the opinions of other authors on multiple myeloma and present their own impressions based upon a careful review of 15 personal cases. Three main types of tumors are recognized: bone marrow tumors, extramedullary tumors and those which have spread generally from one of these two sources either to the viscera or as a plasma cell leukemia. Although it is admitted that the bone tumors may be single, the authors state that one must be sure that a single tumor is not the first expression of what may later become a multicentric disease. For this assurance years of observation may be necessary. Pain is the most common and usually the first symptom. Later the general symptoms appear but only when the tumors are multiple. These consist in malaise, weakness, anemia and cachexia. The complications are pathological fracture and compression paraplegia in the spinal forms.

The extramedullary tumors are often mistaken for carcinoma and usually are present in the mouth and

upper air passages. More rarely they are observed in the conjunctiva lymph nodes pleura mediastinum spermatic cord, thyroid gland ovary intestines kidneys and skin. They may have a variable history following all variations from a completely benign course to local and even distant invasion, while others have an ultimate bone involvement indistinguishable from multiple myelomatosis.

In discussing the morbid anatomy and microscopic appearance of these tumors, the authors call attention to the fact that the degree of malignancy can be estimated by the degree of variation in the cell type the frequency of mitotic figures and evidences of local invasiveness. These features were most marked in their cases which showed multiplicity than in those with solitary lesions. In the nasopharyngeal tumors, the differentiation between these and granulomatous lesions may be difficult. The uniformity of the cellular pattern, the absence of organisms, and failure to invade the surface epithelium, as well as their radiosensitivity suggest their neoplastic nature.

The biochemical features are discussed. These include the presence of Bence-Jones protein and the abnormal serum protein as well as the frequently concomitant amyloidosis. There may be renal changes, plasma cell invasion of the liver and spleen, and finally anemia and a plasma cell leucemia.

The authors believe that the various clinical and pathologic types merge into one entity further that the widespread disease is not one of metastasis, but rather of changes of multifocal origins and that the disease may exist in a variety of forms which should not however, be considered as different manifestations of the disease, but rather as gradations in extent and activity of the same disease process.

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## DUCTLESS GLANDS

**The Role of the Steroid Hormones in the Relaxation of the Symphysis Pubis of the Guinea Pig.** M. A. ZARROW *Endocrinology* 1948, 47: 79.

Relaxation of the symphysis pubis of the guinea pig may be produced by treatment with (a) estradiol (b) estradiol and progesterone, and (c) estradiol and relaxin. In the castrated, hysterectomized guinea pig progesterone is without effect where as in the presence of a uterus, treatment with both estradiol and progesterone shortens the time required for pelvic separation as compared with estradiol treatment alone, and results in the formation of endogenous relaxin.

Relaxin is effective in both castrated and castrated and hysterectomized guinea pigs which have been pretreated with estradiol and produces relaxation in 6 hours. This is a much shorter time than that following treatment with estradiol alone or estradiol and progesterone.

It is concluded that relaxation of the symphysis pubis of the guinea pig may take place by means of two different procedures (1) prolonged treatment with estradiol, which apparently has a direct effect on the symphysis, and (2) treatment with relaxin—exogenous relaxin may be injected into an estrogen-primed guinea pig or endogenous relaxin may be formed after treatment with estradiol and progesterone in the presence of a uterus.

It is noted that optimum relaxation with the steroids is obtained when progesterone and estradiol are given simultaneously. Deoxycorticosterone acetate is approximately one-tenth as active as progesterone in its ability to produce the formation of relaxin and pubic relaxation.

JOHN J. MALONEY, M.D.

# SURGERY

## GYNECOLOGY AND OBSTETRICS

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### CARCINOMA OF THE STOMACH

#### The Validity of Basing Prognosis upon Borrmann Typing or the Presence of Metastases

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**I**N this paper is presented an analysis according to Borrmann's classification, of the relative influences of regional metastases and the gross anatomic types of gastric carcinomas on postoperative survival.

Schindler has recently offered evidence that the prognosis and perhaps the advisability of any therapeutic procedure for carcinoma of the stomach may be based upon the Borrmann type of the tumor. Borrmann separated the gastric carcinomas into 4 gross types: I, sharply demarcated polypoid carcinomas; II, sharply demarcated ulcerated carcinomas; III, partly infiltrating carcinomas; IV, diffusely infiltrating carcinomas. Combining types I and II as limited and types III and IV as infiltrative groups, Schindler noted that there was a much higher resectability rate and lower mortality rate for the former group. Of a series of 239 cases which he analyzed, resection was performed in 167. Exclusion of postoperative deaths and palliative resections left 107 resections for cure. Of this group among those in which both the course and type of tumor were known there were 7

three year cures (3 type I, 3 type II and 1 type IV) and 4 five year cures (2 type I, 2 type II). It was concluded that the patient with a limited tumor has a 10 to 13 times greater chance of a three year cure than has the patient with an infiltrative tumor, and that for the latter no 5 year cure appears possible. On the basis of his data, Schindler questioned the advisability of resection of infiltrative tumors.

This view challenges the belief that as many carcinomas as possible should be resected and served as the stimulus for a review of the material at this clinic with special reference to Borrmann types of tumor. Another point however seemed to be of probable importance. It is obvious that survival is dependent on complete removal of the tumor and the likelihood of such removal should in the case of the stomach just as for other organs such as the breast, be to a degree reflected in the presence or absence of regional metastases. We have consequently compared the effects of the gross anatomic types of carcinoma and regional metastases upon the survival rates.

#### PRESENTATION OF DATA

In the period 1938-1943 inclusive the diagnosis of carcinoma was made in 342 individuals and gastric resection was performed on 177 of the group. The follow up is complete

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TABLE I.—COURSE FOLLOWED BY 124 PATIENTS IN RELATION TO THE BORRMANN TYPES OF THE RESECTED CARCINOMAS

	Type I	Type II	Type III	Type IV	Total
Total cases	4	35	27	18	4
	(3.2%)	(28.2%)	(21.7%)	(14.5%)	
Postoperative deaths		6	6	12	24
Possible survivors		29	21	46	300
Failed to live 3 years		22		23	7
Lived 3 years	3	9	9	3	20
Lived 5 years		3	4	2	13
Alive June, 1947*		6	6		

\*Includes patients who have survived 3 years, but have not yet been exposed to 5 year period.

to June 1947 in all cases. The data presented however concern only the 124 patients whose resected stomachs were available for re-examination and suitable for accurate determination of the Borrmann types of the tumors.

Although most tumors fall readily into the Borrmann types here as in other classifications, one must be arbitrary in some instances. We have been particularly critical of the determination of the limited tumors (types I and II). The extent of a tumor as determined by inspection of its surfaces and palpation is sometimes deceptive and we have also examined cut surfaces in order more accurately to segregate those tumors which presented a clearly defined advancing border. The several group designations concern only the manner of growth and have nothing to do with size. Thus, type IV tumors may range from small lesions apparently confined but without demonstrable borders, in a small segment of the excised stomach to those which obviously infiltrate the entire organ. Those specimens which included direct extensions to adjacent organs such as liver or colon have been classified with respect to the character of the tumor and such direct extensions have not been classed as metastases.

The presence of metastases in lymph nodes was determined by routine methods of examination. In instances in which the original examination had failed to demonstrate involved nodes the specimens were searched for further nodes, which if found, were sectioned. For the purposes of this paper no distinctions are made

relative to numbers of nodes involved and they are considered simply as positive or negative for metastatic carcinoma.

For the 124 patients the distribution of the Borrmann types was as follows: 4 (3.2%) were of type I, 35 (28.2%) were of type II, 27 (21.7%) were of type III, and 58 (46.8%) were of type IV. Combining types I with II and III with IV the series presents 39 (31.4%) 'limited' tumors and 85 (68.6%) 'infiltrating' tumors. This distribution approximates that found by Schindler in 87 cases where 34.5 per cent were limited and 65.5 per cent were infiltrating.

Table I summarizes the course followed by the 124 patients with reference to the Borrmann types of their tumors. There were 24 postoperative deaths. For the limited tumors (types I and II) the mortality rate (6 of 39 patients) was 15.4 per cent. For the infiltrating tumors (types III and IV) the mortality rate (18 of 85 patients) was 21.2 per cent. One hundred patients survived resection and were discharged from the hospital. Their further course is shown in Table I and is summarized relative to both type of tumor and metastases in Table II. All of the deaths in this group have been due to recurrence of carcinoma. A few patients have lived 3 years but have not yet lived 5 years. They are included among those listed as living in June, 1947 in Tables I and II.

Of the 4 patients with type I tumors, 3 (3 without and 1 with metastases) survived 3

TABLE II.—COURSE FOLLOWED BY 100 PATIENTS WHO SURVIVED RESECTION IN RELATION TO BORRMANN TYPES OF CARCINOMAS AND THE PRESENCE OR ABSENCE OF METASTASES

Type	Nodes not involved				Nodes involved			
	Possible per victims	3 year survivors	5 year survivors	Alive June, 1947	Possible per victims	3 year survivors	5 year survivors	Alive June, 1947
I								
II	8	5	4	4				
III	4				7	5	3	4
IV	7	4	3	3	29	4		
Total	22	14 (77.3%)	9		79	14 (17.7%)	4	7

\*Includes patients who have survived 3 years, but have not yet been exposed to 5 year period.

years One patient (without metastases) survived 5 years

Twenty nine of 35 patients with type II tumors survived resection and of this group 20 (17 with demonstrable metastases) failed to live 3 years Nine patients (5 without and 4 with metastases) survived 3 years. Five patients (4 without and 1 with metastases) survived 5 years. An additional patient (with metastases) was living and well in June 1947 but had not yet survived 5 years.

Twenty-one of 27 patients with type III tumors survived resection and of this group 12 (all with metastases) failed to live 3 years. Nine patients (4 without and 5 with metastases) lived 3 years. Four patients (1 without and 3 with metastases) have survived 5 years. An additional 2 patients (one with and one without metastases) were living and well in June 1947 but had not yet survived 5 years.

Forty-six of 58 patients with type IV tumors survived resection and of these 38 (3 without metastases) failed to live 3 years. Eight patients (4 with 4 without metastases) lived 3 years. Three (without metastases) lived 5 years. An additional patient (without metastases) was living and well in June 1947 but had not yet survived 5 years.

From the data in Table I it may be seen that, combining types I and II as limited tumors

TABLE IV — ASSOCIATION BETWEEN THE PRESENCE OR ABSENCE OF METASTASES AND POSTOPERATIVE SURVIVAL FOR PATIENTS WITH A 5 YEAR FOLLOW UP (BORRMANN TYPE HELD CONSTANT)

A. Limited carcinomas (Borrmann types I and II)						B. Infiltrating carcinomas (Borrmann types III and IV)					
Nodes						Nodes					
Survivals	Negative	Positive	Totals	Survivals	Negative	Positive	Totals	Deaths	Negative	Positive	Totals
1 = 0	4	6		1 = 1	5	5	7		1 = 1	5	5
+3				+3	5	5			+3	5	5
5		7	6	5	6	5			5	5	5
8				8	8	5			8	5	5
+3				+3	8	5			+3	5	5
Totals	0	3	3	Totals	1	5	6		1	5	6
XI =	0.6	P(=)	.01	XI =	4.1	P(<)	.0				

and types III and IV as infiltrating tumors among those patients who survived resection there are 33 limited and 67 infiltrating tumors. The 33 patients with limited tumors accounted for 12 of the 29 three year survivors and 32 of them accounted for 6 of the 13 five year survivors. The 67 patients with infiltrating tumors provided 17 of the 29 three year survivors and 64 of them provided 7 of the 13 five year survivors. Thus it is apparent that all up the smaller group they provide a proportionately larger share of the 3 and 5 year survivors. It may be seen in Table II that 21 patients representing all Borrmann types in whom metastases were not demonstrated provided 15 three year survivors, and 20 patients without metastases provided 9 five year survivors. Of 79 patients with metastases 14 survived 3 years and of 76 with metastases 4 survived 5 years. The question is then raised whether it is the gross type of carcinoma which is crucial to survival or whether another variable related to the type of tumor, namely metastases is more important. It is pertinent to know what each contributes to the total correlation with postoperative survival independent of the other variable.

The data have been subjected to statistical analysis. The material is not large enough to

TABLE III — ASSOCIATION BETWEEN THE PRESENCE OR ABSENCE OF METASTASES AND POSTOPERATIVE SURVIVAL FOR PATIENTS WITH 3 YEAR FOLLOW UPS (BORRMANN TYPE HELD CONSTANT)

A. Limited carcinomas (Borrmann types I and II)						B. Infiltrating carcinomas (Borrmann types III and IV)					
Nodes						Nodes					
Survivals	Negative	Positive	Totals	Survivals	Negative	Positive	Totals	Deaths	Negative	Positive	Totals
1 = 1	5	5	12	1 = 1	5	5	17		1 = 1	5	5
+3	5	5		+3	5	5			+3	5	5
5	5	5	11	5	5	5	90		5	5	5
8	5	5		8	5	5			8	5	5
+3	5	5		+3	5	5			+3	5	5
Totals	3	5	13	Totals	1	5	6		1	5	6
XI =	5	P(=)	.01	XI =	7	P(<)	.00				



TABLE V — RELATIONSHIP OF BORRMANN TYPE TO POSTOPERATIVE SURVIVAL FOR PATIENTS WITH A 3 YEAR FOLLOW UP (PRESENCE OR ABSENCE OF METASTASES HELD CONSTANT)

A Nodes negative				B Nodes positive				
Borrmann types				Borrmann types				
	Limited	Infiltrating	Total		Limited	Infiltrating	Total	
Survivals	7	8	5	Survivals	—3	9		
	7	7				1		99
	—0	+0				+09		—09
Deaths			4	Deaths	18	47	65	
	9					18		46
	+0	—0				—09		+09
Totals				Totals	3	65	70	
X=				7				

permit segregation into each of the four Borrmann types without raising serious statistical problems relative to small numbers. Therefore the types were grouped as indicated into limited and infiltrating tumors. The 100 patients who survived resection were divided accordingly and within each group the determination of the relationship of metastases to 3 year survival is freed of the influence of the Borrmann type since the latter variable is held constant. Likewise the relationship between Borrmann type and survival was determined by dividing the patients into 2 groups representing those with and those without metastases thus holding the latter variable constant. The 5 year survival rates were similarly considered for the 96 patients concerned.

The relationship of metastases to survival, freed of the influence of the Borrmann types is shown in Tables III and IV for 3 and 5 year survivals, respectively. The first entry in each basic cell of the tables defines the actual frequency  $a$ . The next specifies the theoretical number  $t$  of cases to be expected in each cell if no relationship exists between metastases and survival. The remaining entry is the deviation of the actual frequency from the theoretical  $a-t$  in number in all 4 cells but differing in sign.

The data of Table III show that among 33 patients with limited tumors, 7 of 10 without metastases and 5 of 23 with metastases sur-

TABLE VI — RELATIONSHIP OF BORRMANN TYPE OF CARCINOMA TO POSTOPERATIVE SURVIVAL FOR PATIENTS WITH A 5 YEAR FOLLOW UP (PRESENCE OR ABSENCE OF METASTASES HELD CONSTANT)

A Nodes negative				B Nodes positive			
Survivals	Borrmann type			Survivals	Borrmann type		
	Limited	Infiltrating	Total		Limited	Infiltrating	Total
	5		9			5	77
5	5	1—		8			
	+0	—05		—0	+0		
Deaths	5	6		Deaths	21	5	
	55	55			208	5	
	—05	+05			+0	—0	
Totals	20			Totals	54	74	

Class: possible abnormal — X, not calculated

vived 3 years and that among 67 patients with infiltrating tumors, 8 of 11 without metastases and 9 of 56 with metastases survived 3 years. Table IV shows that among 32 patients with limited tumors, 5 of 10 without metastases and 1 of 22 with metastases survived 5 years, and that among 64 patients with infiltrating tumors, 4 of 10 without metastases and 3 of 54 with metastases survived 5 years.

The association between survival and metastases is definite within both groups of carcinomas. In each of the tabulations (panels A and B of Tables III and IV) more patients died when metastases were demonstrated and more lived when metastases were not found than should theoretically be expected if metastases did not affect the probability of 3 or 5 year survival. It is clear that these differences are not chance deviations because the  $\chi^2$  criterion shows each considered alone, to be significant<sup>1</sup>. Taken collectively there is no reason to doubt that the association is real. The  $\chi^2$  values for the two panels of Table III may be combined, giving a  $P$  of considerably less than 1 in a thousand. Similarly the two panels may be combined in Table IV where it is found that  $P$  lies between 1 and 2 per thousand.

A probability of less than 5 per cent that each set of 4 differences would arise through chance alone is considered here as significant. This conforms to standard practice in statistical analysis.

The relationship of the Borrmann types to survival considered independent of the presence or absence of metastases is shown in Tables V and VI for 3 year and 5 year survivals respectively. Among 21 patients without metastases 7 of 10 with limited tumors and 8 of 11 with infiltrating tumors survived 3 years. Of 79 patients with metastases 5 of 23 with limited tumors and 9 of 56 with infiltrating tumors survived 3 years. Among 20 patients without metastases 5 of 10 with limited tumors and 4 of 10 with infiltrating tumors survived 5 years. Among 76 patients with metastases 1 of 22 with limited tumors and 3 of 54 with infiltrating tumors survived 5 years.

In each of the cells of Tables V and VI the actual frequency deviated from the theoretical (based on no association) by less than unity and in 3 of 4 tabulations (panels A and B of Table V and panel A of Table VI) the agreement with expectation is as close as it can be since observed frequencies must be whole numbers. The one tabulation (Table VI B) in which a statistical test for real discordance has some meaning yields a probability that such discrepancies or worse would arise by chance approximately 4 times out of 5 ( $P$  is 0.8, approximately). It is therefore demonstrated that when the presence or absence of metastases is ignored, the Borrmann classification owes its relationship to postoperative survival solely to the fact that the infiltrating forms have a higher probability of metastases.

#### COMMENT

Schindler suggested that in view of the poor prognosis in patients with infiltrating tumors the combined use of gastroscopy and x ray might serve to separate patients with limited tumors as the more likely candidates for surgery. His contention however, that clinical determination of the Borrmann type might form the primary basis of decision as to operative interference seems now to rest on the correlation between the gross types and the presence of metastases. Tables I and II show that the correlation is not perfect. Of 67 patients with infiltrating tumors 17 survived at least 3 years and 8 of the 17 showed no metastases. Of 33 patients with limited tumors, 21 failed to live 3 years and of these, 18 had

metastases. The Borrmann types alone then even when determined postoperatively, prove to be inadequate indicators of the wisdom of surgical procedures. On the other hand we find that there is the probability of survival for a period of 3 years in approximately 70 per cent (15 of 21 patients) of those cases in which metastases are not found but that the probability falls to about one-quarter of that figure when metastases are demonstrated (17 of 79 patients).

The examination employed for determination of metastases is relatively crude. Sample sections of nodes undoubtedly miss some small metastases; some small nodes are not found, and there is in addition no certainty, for any given specimen, that all tumor bearing nodes have been removed. However, the data indicate that for gastric carcinoma, as for carcinoma elsewhere in the body, the likelihood of complete removal of tumor bearing tissue is reflected to a high degree in the determination, even by routine methods, of the presence or absence of metastatic tumor in the regional lymph nodes.

To the extent that the infiltrating tumors are less readily excised without leaving microscopic extensions in the gastric wall and more likely to have metastasized, they offer a poor prognosis compared to the limited tumors. However in some patients infiltrating tumors are confined to excised tissue to a degree consistent with long survival. The limited tumors offer a better prognosis only when lymph nodes are not involved and the presence or absence of metastases cannot be determined preoperatively. To restrict surgical excision to those patients with limited tumors would deprive some patients though admittedly few with infiltrating tumors of the chance for long survival and many more of palliation with reasonable comfort for periods averaging up to 2 years (State, Moore, and Wangenstein). With out therapy most patients live but a few months after the diagnosis is established. In view of the low risk and short convalescence accompanying gastric resection, it would appear difficult to argue that the opportunity of over 22 months of relative comfort and the chance of longer survival should be withheld from any patient.

Thus it would seem that attempts to predict the survival of patients with carcinoma of the stomach by the gastroscopic typing of their lesions are not justified. If patients with Borrmann types III and IV are denied operation a certain number of lives will be needlessly lost. It has been shown that these patients do have a reasonable chance of survival if no metastases are present.

It may further be noted that the kind of data upon which this study is based has now been improved. In 1945 the operability rate for carcinoma of the stomach at this clinic was 89 per cent, resectability 79.6 per cent and the mortality rate 4.8 per cent. In addition the recent introduction of the thoracoabdominal approach has increased the chances of removing infiltrating and high lying lesions as well as metastases. In the last 16 total gastrectomies at this clinic, there has been but one death. These techniques should favorably influence the removal of infiltrating lesions, and contribute to longer survival.

#### CONCLUSIONS

1 The presence or absence of demonstrable metastases in regional nodes among patients subjected to gastric resection for carcinoma has a greater prognostic value than does the Borrmann type of the tumor.

2 The Borrmann type affects the prognosis of groups of cases to the extent that the limited tumors provide a proportionately large number of patients free of metastases while the infiltrating tumors which are more numerous are more likely to have metastasized.

3 The presence or absence of metastases cannot be accurately determined preoperatively and no patient should be denied operation because of the type of tumor he may be determined to have.

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# THE FIVE YEAR SURVIVAL RATE IN CASES OF COMPLETELY OBSTRUCTING ANNULAR CARCINOMA OF THE DESCENDING COLON AND SIGMOID

## A Pathologic Study

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**O**BSTRUCTION superimposed on an existing malignant lesion of the colon is a serious complication. Long before 1810 when Thomas Copeland described stenosing carcinoma of the colon many procedures, beginning with the decompression colostomy first performed by Littre in 1710, had been devised for relief of this condition. By 1839 Amussat, the French surgeon, was performing decompression colostomy on both the right and left halves of the colon. Later attempts were made to extirpate the malignant lesion. Kohler in 1881 reported the first successful resection. Mikulicz in 1903 described his exteriorization procedure and reported a mortality rate of 12.5 per cent in 16 cases. Miles at the turn of the century, favored the combined abdominoperineal approach. In every procedure, however, obstruction continued to plague the surgeon, keeping his operative mortality uncomfortably high. With the advent of chemotherapy there is little doubt that the mortality rate has been revised downward. But what of the 5 year survival in cases in which obstruction complicates the presence of colonic carcinoma?

We have felt for some time that obstruction itself in some way decreases the expected 5 year survival rate. A review of the literature offered little actual statistical support of this hypothesis. However, 5 important points were brought out which were conceded to be contributing factors. (1) Damage to the bowel wall by the increased intraenteric pressure has been reviewed and studied by many men (2, 14-18) who have shown that permeability of the wall of the obstructed colon is increased and that lymphatic absorption appears to be

increased. We believe that this may also facilitate earlier metastasis of carcinoma cells. (2) The inflammatory swelling, distention, engorgement of vessels and edema of the intestinal wall and of the carcinoma itself probably tend to break down any protective forces. (3, 8, 10, 11) brought into operation by the tissues of the host. (3) The increasing hypertrophy of the musculature of the colon and the attempts by the bowel to force fecal material through an increasingly smaller aperture may result in traumatizing and vigorous massaging of the tumor (7, 8) which may induce earlier and more widespread metastasis. (4) The motility of cancer cells is of debatable significance but such motility was demonstrated by Cormalt in 1872 and again later (8, 9). Also there exists the possibility of the elaboration by carcinoma cells of some lytic or other damaging property which enables malignant cells to break through the basement membrane and invade the deeper tissues. Whatever this invasive property might be, the intestinal wall damaged by obstruction would offer an easier pathway of extension. (5) The ileocecal valve when competent produces a closed loop type of obstruction. Whether it is done by valve or sphincter action, the relatively low intraenteric pressure produced, if it is exerted for 27 to 32 hours, will destroy the viability of the bowel or definitely impair its normal function. (18) The aforementioned changes in the wall are accentuated.

### FACTORS CONTRIBUTING TO THE OBSTRUCTION

Gruenfeld listed 4 factors contributing to the development of colonic obstruction, namely (1) inflammatory edema, (2) impaction of solid feces, (3) kinking of the bowel with varying degrees of intussusception and

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(4) fatigue of the intestinal muscle above the point of stenosis. Rankin considered 3 factors in reference to the left versus the right portions namely (1) the character of the intestinal wall itself which is less elastic and smaller in diameter than its fellow in the right half (2) the fecal current which is formed and hard in contradistinction to the liquid stream of the right side and (3) the pathologic characteristics of the growth which in lesions of the left portion of the colon has a tendency to encircle the lumen and thus bring about slow stenosis. From our study of the size of the obstructing annular lesions as compared to similar nonobstructing lesions we would conclude as others have that the obstruction is dependent too on the amount of fibrosis present a reaction on the part of the host to the presence of cancer cells.

#### PURPOSE OF STUDY MATERIAL AND METHODS

*Purpose* We have often noted in the operating room and in the surgical pathology laboratory that at the time of the initial exploration involvement of the regional nodes or metastasis to the liver frequently is associated with small but obstructing carcinomas of the left part of the colon. We have observed, too that patients who have undergone resections for favorable lesions of small size often returned in from 1 to 3 years because of unmistakable signs or symptoms of metastatic carcinoma. We therefore considered examination of the factor of obstruction as pertinent in the 5 year survival rate of patients who had obstructing annular carcinoma of the left portion of the colon.

*Material* Two hundred and fifty four cases of carcinoma of the left portion of the colon in which operation had been performed in the 36 years, 1910 through 1945 and in which obstruction was present, were reviewed. All cases were discarded except those in which complete clinical obstruction was present and for which cecostomy or colostomy was required for decompression. All lesions of polypoid type were discarded. All cases of carcinoma occurring at or below the peritoneal fold and at the splenic flexure were eliminated in order that we might determine the reaction of the bowel to the obstruction both as to the per-

centage increase in the circumference of the lumen above the carcinoma and to the percentage increase in the thickness of the muscularis propria above the lesion. The final group studied consisted of 78 cases of completely obstructing annular carcinoma of the sigmoid and descending colon. In 55 of these the lesions occurred in the sigmoid and in 23 in the descending colon. All lesions had been removed surgically and the specimens had been preserved in 10 per cent commercial formalin (40 per cent formaldehyde). For comparison all cases of surgically removed non-obstructing carcinomas of the descending colon and sigmoid encountered at the Mayo Clinic in 10 years, 1930 through 1939 were studied again all cases of polypoid type were excluded. This control group totaled 329 cases.

In order to determine the incidence reference is made to the total of 2,089 cases of carcinoma of the descending colon and sigmoid in which operation was performed at the clinic during the 36 years covered by the detailed study.

*Methods* Gross pathologic studies were carried out on each specimen to ascertain that it was in fact completely occluding the lumen of the bowel and that it was an annular or napkin ring type. Each carcinoma was carefully measured in three dimensions to determine the cubic content of tumor tissue. The circumference of the lumen and the thickness of the muscularis propria were measured proximal and distal to the carcinoma to the nearest 0.5 millimeter and charted. Blocks of tissue then were cut from the proximal and distal edges of the tumor and at the peritoneal surface for grading (Broders) and classification by Dukes method. A careful search was made for involved nodes and each was sectioned for study. All specimens were placed in fresh 10 per cent solution of formalin and later studied under the microscope in paraffin sections stained with hematoxylin and eosin.

#### INCIDENCE AGE, AND SEX

Annular carcinomas comprise 60 to 70 per cent of all carcinomas of the colon encountered clinically and require in an average case, about 2 years to encircle the bowel completely

TABLE I — OBSTRUCTING AND NONOBSTRUCTING CARCINOMA\* OF THE DESCENDING COLON AND SIGMOID A COMPARISON OF THE GRADE OF MALIGNANCY

Grade	Nonobstructing		Obstructing	
	Cases	Per cent	Cases	Per cent
	34	5		.8
	149	75.7	56	7.8
3	38	1.6	0	.8
4	8	4		.6
Total	180	100	78	100

\*Polypoid lesions, large percentage of which are grade 3 are not included in this series.

(4) Nevertheless obstructive phenomena dominate the clinical picture of carcinoma of the left part of the colon with 75 to 80 per cent of patients having obstructive symptoms at the time they first consult a surgeon (1, 5, 12, 13). A higher percentage give roentgenologic evidence of obstruction and about half of these patients have colicky pain (1). Obstruction is usually a late sign of malignant growth of the colon which occurs as a slowly progressive process. About 5 per cent of patients however will have signs of acute obstruction as the first symptom (13, 14). In our series 2,089 patients with carcinoma of the sigmoid and descending colon have been operated on. In 254, an incidence of 12.2 per cent acute or subacute obstruction grade 1 to 4 (grade 4 represents complete obstruction) was found. Complete obstruction was present in 78 cases, an incidence of 3.7 per cent for the entire group and 30.7 per cent for the group in which some degree of obstruction was encountered. Therefore in about a third of cases in which obstruction was present, complete obstruction had occurred before the surgeon saw the patient.

There were 41 women and 37 men in this series. The number of women in the younger age groups was somewhat greater than of men.

#### PATHOLOGIC DATA

*Size.* It is generally agreed that there is little correlation between the size of a malignant colonic lesion and the degree of obstruction present. In our series of 78 cases however paradoxically enough, the cubic contents of

TABLE II — FIVE YEAR SURVIVAL RATE ACCORDING TO DUKES CLASSIFICATION AND BRODERS GRADING

Dukes classification	Traced patients	Lived 5 or more years		Broders' grade	Traced patients	Lived 5 or more years	
		Number	Per Cent			Number	Per Cent
A	11	4	36.4			1	5
B	9		2		5	7	8
C	15	3	20	5	7	1	14.3
				4	1	0	—
Total	35	9	25.7		35	9	25.7

the lesions which produced obstruction averaged 40 cubic centimeters as against 64 cubic centimeters for those which were not obstructive (control series).

*Grade.* Apparently the grade of the lesion and the incidence of obstruction are not related (Table I). Although our series of cases is small the incidence of the obstructing and nonobstructing lesions of various grades of malignancy is similar. The 5 year survival rates in cases graded by the Broders method and also classified by Dukes method are recorded in Table II. We do not intend to imply that Dukes classification is not of value for we know that it is in other and larger series. However the statistics in this series indicate that obstruction in some way materially alters the 5 year expectancy as 'predicted' by Dukes' method of classification.

*Hypertrophy and dilatation.* Seven specimens could not be accurately studied from the standpoint of hypertrophy and dilatation. Two were gangrenous, and 5 had been subjected to exteriorization and were so distorted that accurate measurement was impossible. In the remainder we found the mean thickness of the muscularis propria above the lesions to be exactly double that of the mean thickness below the lesions (2.66 and 1.33 mm. respectively) and the circumference of the lumen above the lesions to be approximately double that of the circumference below the lesions (7.93 and 4.50 cm., respectively). All of these specimens had been preserved in formaldehyde and it is probable that there was a greater percentage of shrinkage in the proximal edematous part of the bowel than of the more normal distal part and that the actual

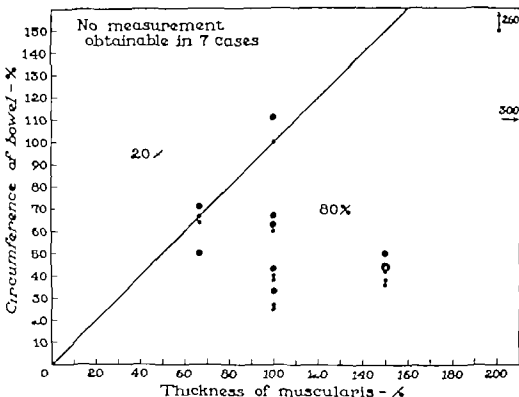


Fig. 1. Comparison of increase in size of lumen to increase in size of muscularis above the obstructing carcinoma.

percentage increase in the luminal circumference was greater than that shown and that there was a similar but less striking difference in the muscularis propria.

In approximately 80 per cent of cases the percentage increase in the size of the muscularis propria above the tumor was greater than the percentage increase in the size of the lumen, whereas in approximately 20 per cent the percentage increase in the size of the lumen of the bowel was greater (Fig. 1). One might think that this 20 per cent represents cases in which obstruction was of short duration. However in 3 of the cases (about 20 per cent) in which the increased dilatation was greatest obstruction had been present for only 1 day before surgery in 5 for 7 to 14 days and in 4 between 2 and 5 days.

#### RELATION OF DAYS OF OBSTRUCTION TO THE SURVIVAL RATE

The relationship of the duration of obstruction in days before operation to the survival

rate was investigated. The duration of obstruction was taken from the records and in some cases only an approximation could be made. No relation between duration of obstruction and length of survival is evident. It was somewhat of a surprise to see that 4 of the 9 patients who lived 5 years after operation had had obstruction for 7 days to 2 weeks before operation. We expected to find a higher incidence of 5 year survivals in cases of obstruction of short duration, but our data do not substantiate this impression. One explanation may be that complete obstruction occurred early in these cases and that impairment of the mesenteric circulation and decreased intestinal activity eliminated the factor of massage or an incompetent ileocecal valve prevented a closed-loop type of obstruction with minimal damage of intestinal wall.

#### THE FIVE YEAR SURVIVAL RATE

Of the 78 patients who had completely obstructing annular carcinoma of the descending

TABLE III—SURVIVAL RATES FOR THREE AND FIVE YEARS IN CASES OF OBSTRUCTING AND NONOBSTRUCTING ANNULAR CARCINOMA OF THE DESCENDING COLON AND SIGMOID\*

Group	Survived 3 years				Survived 5 years			
	Patients		Lived 3 years or more		Patients		Lived 5 years or more	
	Total	Traced	Number	Per cent	Total	Traced	Number	Per cent
Nonobstructing lesions†	320	323	205	63.4	320	321	166	51.7
Obstructing lesions‡	47	45	5	5.1	37	35	0	0

\*Hospital deaths not included in this series.

†All patients who had resections of the colon for nonobstructing adenocarcinoma at the clinic from 1930 to 1939 inclusive are included.

‡All patients who had resections of the colon for obstructing adenocarcinoma of the descending colon or sigmoid at the clinic in 1930 or earlier are included for the determination of the 3 year survival rates and those who had them in 1941 or earlier for the determinations of the 5 year survival rates.

colon and sigmoid 39 were seen in 1939 or earlier. Since the follow up for survival was as of January 1, 1945 these were used to determine the 5 year survival rate (Table III). Data on the 2 patients who died in the hospital were not included in Table III. Of the 37 remaining patients 2 could not be traced for 5 years after operation. The 3 year survival rates also are shown. However, these are not of great significance for this period of survival might be expected after palliative surgery. Such is not true for the 5 year group. A comparison of the 5 year survival rate with that in cases of nonobstructing annular type of lesion shows that for completely obstructing annular carcinoma of the descending colon and sigmoid the rate is approximately half that for the nonobstructing annular type of carcinoma. The 5 year survival rate in the cases of nonobstructing annular carcinoma of the descending colon and sigmoid was 51.7 per cent and that in cases of completely obstructing annular carcinoma was 25.7 per cent.

#### SUMMARY AND CONCLUSIONS

The 5 year survival rate in 37 cases of completely obstructing annular carcinoma of the descending colon and sigmoid in which resection was performed is compared with the 5 year survival rate in cases in which nonobstructing lesions had been treated surgically.

These rates were 25.7 per cent and 51.7 per cent, respectively.

The five factors which may contribute to the lowered 5 year survival rate are (1) damage to the intestinal wall with increased permeability and increased lymphatic absorption (2) hypertrophy of the musculature which produces a massaging and traumatizing action to the carcinoma at the site of obstruction (3) inflammatory swelling and edema which cause breakdown of any mechanical protective factor and of any protective forces elaborated by the host (4) the invasive property of the cancer cell whether it be motility or some lytic action which is facilitated by the effect of the factors just mentioned, and (5) the ileocecal valve which may produce a closed loop type of obstruction.

The size of the lesion is of no significance in prognosticating the presence of metastasis, and the volume (cubic centimeters) of malignant tissue is actually less in the cases of obstruction than in the cases in which no obstruction was present.

No correlation was found between the grade of the lesion and the incidence and degree of obstruction or between the duration of obstruction in days and the survival rate.

We realize of course, that this is a small series of cases on which to base any definitive conclusions but with the strict criteria for obstruction used namely, complete obstruction requiring a colostomy or cecostomy for decompression before removal of the lesion, the series would of necessity have to be small. Notwithstanding we do believe that such a difference in the 5 year survival rate in cases of obstructing and nonobstructing carcinoma of the descending colon and sigmoid 26 per cent in this series, is significant. This difference is not due to a difference in the grade of malignancy of obstructing carcinomas but rather apparently to the condition of the intestinal wall attending the complication of obstruction.

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# COMEDOMASTITIS

## A Clinical and Pathologic Study of Data in 172 Cases

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COMEDOMASTITIS is a disease of the breast characterized by dilatation of the lactiferous ducts which are distended with inspissated grumous material that may be expressed from cut ends of the ducts much as comedones are expressed from ordinary blackheads. It is a disease of the large ducts in contrast to chronic cystic mastitis which is a disease of the acini and ductules. Marked clinical similarity to mammary malignancy may be present when comedomastitis results in an indurated area of the breast which is fixed to the skin and is associated with a retracted nipple. Even the pathologic picture may be confused with that of carcinoma unless the true nature of the lesion is appreciated.

### REVIEW OF LITERATURE

The use of the term 'comedomastitis' to describe this condition has gained limited acceptance (15 19 45 57). Dilatation of the ducts has long been known to exist in chronic cystic mastitis and senile atrophy of the breast but Bloodgood (6-10) was the first to consider this type of lesion as a clinical and pathologic entity which he called varicocele tumor of the breast. He noted that the condition was usually bilateral and that it was more common in women more than 45 years of age. Parity appeared to have little influence on the frequency of occurrence. He described dilated thick walled ducts which contained greenish brown milky or creamlike material of varying degrees of viscosity and consistency. Some times induration was so marked that the lesion looked felt and cut like carcinomatous tissue. He found the lesion in breasts that were otherwise normal, senile adenomatous or cystic or malignant. However, he stated that the gross finding of ducts distended with grumous material militated against a diagnosis of mammary carcinoma.

Cheate (12) and Cheate and Cutler (14) expressed a belief that enlargement of ducts resulted from overgrowth of epithelium and excessive desquamation rather than from obstruction. They described (13, 14) conditions clinically similar to comedomastitis and saw dilated ducts with retained secretion in carcinomatous breasts. Adair and Bagg indicated that abnormal drainage from the breast was an important factor in production of cancer. Adair (2) found obstruction which was due to a localized growth of the lining epithelium of the ductules to abnormality of the nipple including inversion bivalving puckering adherence dwarfing and ulceration to fibrous scars across the lumina of ducts to cysts fibroadenoma or inflammation to desiccated desquamated ductal estuaries. Semb found dilatation of the milk ducts in association with fibroadenoma tosis which he stated predisposed to bacterial infection but he could demonstrate no connection between the occurrence of local purulent inflammation and the development of cancer. Handley described duct catarrh wherein plugs of epithelial debris marked the orifices of the milk ducts from which wormlike casts of material could be clinically expressed. There was thickening of the ducts as they converged on the nipple.

In breasts with cystic disease Lewis and Geschickter found ectasia of the ducts which sometimes were filled with material of putty like consistency. They attributed cystic disease to hormonal imbalance and observed that theelin produced similar changes in animals. Later Geschickter described 7 cases in which



titis, and in none of the cases of "cancer" could the source of the growth be traced to the comedomastitis. They concluded that the lesion complex was not primarily related to the proliferative and cystic lesions but that it might occur independently or in unison with the others.

Other authors have reported or described cases similar to those of comedomastitis (5, 11, 16 21-23, 28, 29, 32, 35, 40 42-44 49, 51 55, 57 58). It has been shown that those breasts which have produced large quantities of milk have larger ducts than poorly secreting or non-secreting glands (31). The effects of hormones on the breasts of animals have been summarized by Patey and Shimkin.

#### MATERIAL AND METHOD

The surgical and pathologic files of the Mayo Clinic were searched for the records of all cases in which the diagnosis of comedomastitis had been made for the years 1925 through 1942. Maternal which had been taken at mastectomy in 185 cases and at local mammary resection for comedomastitis in 19 cases and which had been preserved in 10 per cent solution of formalin was secured and studied. In cases in which bilateral mastectomy had been done with a different diagnosis for the lesions in the 2 breasts, the "uninvolved" breast still was reviewed with the idea of picking up minimal or early "comedo" changes. Size and distribution of the ducts were particularly noted although cysts abscesses fibrosis fibroadenoma, carcinoma and papilloma were also looked for. Ducts were often probed or laid open to be certain of their true character. As a rule, one block from each quadrant and one through the nipple of each of the whole breasts was taken so as to demonstrate typical areas of comedomastitis minimal areas and transition zones. When only a portion of the gland was available, one piece was chosen to show the typical pathologic picture. All blocks were placed in a fresh 10 per cent solution of formalin and slides were subsequently prepared by the freezing method and stained with hematoxylin and eosin.

For a better understanding of the condition those cases in which operation was performed solely for the relief of comedomastitis were

considered separately from the group wherein the main diagnosis was carcinoma or papilloma. The first group was represented by material from 144 whole breasts and 19 incomplete breasts in the second group material from 41 cases in which mastectomy had been performed was available for study.

#### PATHOLOGIC CONSIDERATIONS

The size of the involved breasts varied from enormous, fatty glands to shrivelled nubbins. The nipple was available for study in 143 breasts; it was abnormal in 31 breasts, with retraction or inversion in 28 and inflammation in 3. In 1 case the nipple had been surgically removed previously. Fifty-five contained palpable single masses and 16 multiple masses. Fifty-nine breasts were described as diffusely nodular granular cystic or shotty and 23 had localized thickening or nodularity. In only 2 were the dilated ducts noted as being palpable. Fixation of the mass to the skin, or to the nipple, was present 37 times. In 1, a draining sinus was present. In 5 abscesses were identified. Eight contained nodules typical of fibroadenoma and 1 contained a lesion which later proved to be fibrosarcoma. As this seemed to be entirely unrelated to the mastitis the case was included in the benign series.

After section of the gland the most striking feature noted was the presence of comedones which could be squeezed from the ducts like toothpaste from a tube. Although typically grumous, this material varied from an oily secretion to a thick dry form with the consistency of cheese (Fig. 1). The color was white, gray, yellow, green or brown. Many of the ducts were large and thick walled so that they stood out like pipestems, even after the secretion was expressed, but some would collapse to slits. The extent of the ectasia varied from distinct enlargements in scattered sites to markedly dilated cavities that honeycombed the gland. In 29 of the specimens only slight dilatation occurred. In the 96 in which moderate degrees of ectasia occurred, in 8 the ectasia was in scattered parts, in 27 it occurred beyond the nipple only and in 61 it occurred diffusely. In 19 breasts there were marked changes, with large ducts running from the ampulla to the periphery in all sectors. Six of

the excised portions of mammary tissue exhibited minimal to moderate and 2 marked dilatation.

Fibrosis was obvious in the atrophic type of breast in which sections were sometimes difficult to cut. In the fatty organs this was still evidenced by the increased density of the septa. Eighty-seven of the specimens contained macroscopic cysts varying from a minimum of 1 millimeter to 8 centimeters across.

The prominent and distinguishing features of the microscopic structure were the changes in the ducts and periductal tissues. The method of preparation frequently destroyed the retained secretion but where the secretion did persist it consisted of pink-staining amorphous, granular or cellular debris. At times fat laden phagocytes, inflammatory cells, and desquamated epithelial cells were found within the lumen. The distribution and degree of dilatation of the ducts as seen microscopically was, for the most part as indicated in the description of the gross appearance but differences did occur. Even when the ducts seemed diffusely distended a few usually remained almost normal in size and contour. In the most marked cases all ducts seen near the nipple were enlarged (Fig. 2). Some of those that were grossly affected only near the nipple or in scattered areas exhibited microscopic changes in the ductal and periductal tissues indicating diffuse disease. For the most part, the ducts near the nipple were irregular in outline and somewhat collapsed when the retained secretion was lost, but many of the peripheral ducts remained wide open as a result of fibrosis.

Aside from round cell infiltration associated with the lactiferous ducts and the two specimens in which moderately severe subepithelial inflammation had occurred, the nipples were microscopically normal. Although microscopic anatomic obstruction of the neck of the ducts was searched for none was found, except in the aforementioned cases in association with gross deformity.

The epithelium of the ducts near the nipple was normal, but with distention of the duct it thinned and the individual cells tended toward a cuboidal appearance. Occasional vacuolated cells could be found in most specimens.

In 6 of the cases there was an increased number of desquamated cells. In 9 additional cases these changes were present and were associated with a great increase in the number of vacuolated cells.

The peripheral ducts usually were lined by smaller cuboidal cells. The number of cell thicknesses was variable and ranged from 6 to 8 down to a single flattened layer or even to complete denudation (Fig. 3 a and b). The largest most distended ducts or those with the most periductal fibrosis tended to have fewer layers. Those with evidence of little periductal inflammation and minimal dilatation would often have normal epithelium while those with moderate inflammatory changes and distention had more variations in type. In 12 of the cases an increased proliferation was noted within the ducts, with the formation of masses of cells and tiny papillae with or without anastomosing branches. Some of the small ductules were occluded by this overgrowth but none of the epithelium could be called atypical. In isolated areas of the ductal wall of 9 of the specimens were found colostrum-like cells which were large, pale and round with slightly acidophilic cytoplasm and small dense nuclei. The epithelial layer was thickened by masses of these cells which encroached on or filled the lumen (Fig. 4, a and b).

A few of the breasts showed no evidence of periductal reaction to the retained secretion, but the great majority had responded with inflammatory changes which ranged from a slight amount of small round cell infiltration to acute abscess formation. The predominant and universally present type of cell was the lymphocyte. Large wandering cells and plasma cells could usually be identified. In some, chronic granulation tissue with proliferating endothelial cells and fibroblasts was seen. Subacute inflammatory changes which were found in 8 of the breasts were characterized by the presence of many plasma cells, an occasional giant cell and a few polymorphonuclear leukocytes (Fig. 5). Acute or subacute abscesses were identified microscopically in 5 of the cases. In 3 there were pseudotubercles, with giant cells and epithelioid cells. In 10 of the breasts a site of rupture of a duct was visualized invaginating the lumen by granulation tissue and



Fig. 1 Diffuse comedomastitis. The most marked changes are beneath the nipple.



Fig. 2 Cross section of a nipple. Note great dilatation of the ducts immediately beneath nipple  $\times 5$

The stromal fibrosis was more evident in the small atrophic glands where it often caused squeezing and distortion of the remaining lobules of the breast. In others much of the stroma had been infiltrated with fat. In those breasts with evidence of moderate to severe inflammation, the infiltrate extended into the stroma and, in a few instances, the areolar and fibrous tissue of the entire organ was involved.

Usually in the lobules there was only a significant round cell infiltration. Sometimes however the lobules were trapped in the inflammatory exudate which had spread from a nearby duct so that the tubules and acini appeared as scattered epithelial islands in a sea of lymphocytes with the lobular structure being unrecognizable. Nineteen of the specimens contained scattered small lobules with fibrosis and a decrease in the epithelial elements. In one or two of these specimens the lobules approached normal but in most they were definitely atrophic. Early or mild proliferative changes, affecting both the epithel-

exudate was apparent. Marked chronic inflammatory tissue surrounded these areas and was spread through the stroma. Fat laden phagocytes were present in the periductal tissues and in the lumen. The finding of hemosiderin laden histiocytes in the periductal tissues of 8 specimens suggested previous hemorrhage. Periductal fibrosis was often marked so that the ducts were surrounded by concentric rings of hyalin-appearing connective tissue. In these instances the epithelial lining was atrophic and the periductal lymphocytic infiltration was mild to moderate. The infiltrated tissue was separated from the lumen by wide bands of connective tissue.

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Fig 2. Cross section of a nipple. Note great dilatation of the ducts immediately beneath nipple  $\times 5$ .

The stromal fibrosis was more evident in the small atrophic glands where it often caused squeezing and distortion of the remaining lobules of the breast. In others much of the stroma had been infiltrated with fat. In those breasts with evidence of moderate to severe inflammation the infiltrate extended into the stroma and, in a few instances the areolar and fibrous tissue of the entire organ was involved.

Usually in the lobules there was only insignificant round cell infiltration. Sometimes however the lobules were trapped in the inflammatory exudate which had spread from a nearby duct so that the tubules and acini appeared as scattered epithelial islands in a sea of lymphocytes with the lobular structure being unrecognizable. Nineteen of the specimens contained scattered small lobules with fibrosis and a decrease in the epithelial elements. In one or two of these specimens the lobules approached normal but in most they were definitely atrophic. Early or mild proliferative changes, affecting both the epithe-





Fig. 3. a, left, The thinning and flattening of the epithelium that frequently accompanies dilatation of the ducts. Note also the subjacent connective tissue and periductal inflammation.  $\times 300$ . b, Note the thickening that may occur.

lum and connective tissue in the lobules, were present in 35 of the breasts. Sometimes proliferation of the epithelial cells predominated to give extensive formation of new tubules and acinus-like structures. Occasionally the stroma was the more active of the two elements and the scattered compressed and irregular ductules or acini simulated infiltrating malignant tissue. The tubules sometimes showed small degrees of dilatation that did not correspond with the extent of ectasia in the larger ducts. These changes have been called adenofibrosis (54) 'mastodynia' (38) "blunt duct adenosis" (26) sclerosing adenosis (26) and metaplasia (14). Not included were those specimens with pale-staining epithelium, but otherwise these changes were similar to those in fibroadenomatosis microcystica (48).

In 44 breasts, simple cysts with a lining of cuboidal or flattened epithelium were present. In 43 the cysts were associated with large pale staining columnar epithelial cells of the apocrine type giving the picture of Schimmelbusch's disease. For the most part, the cysts did not share in the inflammatory process that so often accompanied comedonasti-

tis. Occasionally there was fibrosis of the wall and a moderate amount of reaction and at times the inflammation had spread from the periductal tissues to include a cyst. Apocrine type of epithelium was also found in 22 of the breasts that did not contain macroscopic cysts. Such epithelium was not found in the ectatic ducts and hence was not considered as evidence of ductal hyperplasia even though papillae with anastomosing and interlacing branches were found within a cyst. The breasts in which cystic and apocrine changes occurred were referred to simply as those with cysts those with cysts and apocrine epithelium or those with apocrine epithelium but without cysts. These would include the cystic disease and adenosis of Geschickter diffuse papillary cystadenoma of Schimmelbusch diffuse nonencapsulated cystic adenomatosis of Bloodgood, fibroadenomatosis cystica of Semb and the cystiferous desquamative epithelial hyperplasia of Cheattle and Cutler. The concurring fibroadenoma and fibrosarcoma were typical in appearance and there was no evidence of dilatation of the ducts within them.

During the course of the study it became evident that most of the diseased breasts fell



Fig. 4. a, left, Colostrum like cells found in an isolated area of the ductal epithelium.  $\times 100$ . b, Heaping up of the

colostrum-like cells so that the lumen of the duct is almost occluded.  $\times 100$

into rather well defined groups, based entirely on the pathologic changes observed. Both the gross and the microscopic findings were evaluated in determining the correct place for each. The distribution of the lesions allowed for division of the lot into three groups. The designation focal was used when the disease was in one localized part or in scattered parts diffuse indicated involvement of the greater share of the duct system. Since the entire

breast had not been removed in 19 instances the extent of the disease could not be determined and these were called "sectional." The severity of the disease in the ducts formed the basis for subdividing each of these 3 groups into "early" and "advanced." The terms did not refer to the actual time the breast had been involved but indicated the degree of the changes in the breast. In "early" disease the periductal fibrosis was absent or minimal the



Fig. 5. a, Subacute inflammation about a duct with erosion of the lining epithelium.  $\times 66$ . b, Rupture of the duct and invasion by granulation tissue in which there are many

foreign body giant cells.  $\times 66$ . c, In this section is shown the granulomatous reaction with the formation of pseudotubercles.  $\times 97$

periductal inflammation was minimal to mild. The amount of retained secretion was small and the dilatation of the ducts was minimal to mild (Fig. 6 a). In advanced disease the periductal fibrosis was moderate to marked, the periductal inflammation was moderate to marked, there was a large amount of retained secretion and the dilatation of the ducts was moderate to marked (Fig. 6 b and c).

Of the 19 biopsy specimens, 11 showed early stages of the disease and 8 showed advanced. In the first three of the whole breast were classified as focal early. These contained one or more areas of comedoma titis in which the changes in the ducts were slight. Only one could be called focal advanced, and it exhibited moderately severe ductal and periductal changes in a scattered area. The diffuse early group consisted of 53 breasts in which there was involvement of most of the ductal system but the changes present were minimal to mild. In only five breasts made up the diffuse advanced group this group included those with the most widespread and most marked disease.

The majority of those specimens with focal or early comedoma titis or both exhibited cystic changes or apocrine epithelium, while the majority of those with marked evidence of diffuse advanced disease exhibited atrophic changes or early proliferation. Conversely in the great majority of those specimens with atrophy or early proliferation there were advanced forms of comedoma titis, while in the majority of those with cysts or apocrine epithelium or both early forms of comedoma titis were present.

The relation ship of the unusual pathologic findings to the type of comedoma titis present is of interest. As would be expected the diffuse advanced group contained the greatest share of those breasts in which complications had occurred. These complications included rupture of the ducts, deposition of hemosiderin about the ducts, subacute inflammation, abscess formation, presence of pseudotubercles and plasma cell mastitis. In contrast the findings indicative of secretory activity, which were excess desquamation or vacuolation beneath the nipple and the presence of colostrum like cells were confined with two ex-

ceptions to the early group. Surprisingly enough the percentage of specimens in the focal groups which showed secretory activity was higher than that in the diffuse groups. The incidence of hyperplasia within the duct did not vary with the stage of the disease. Hyperplasia was not found in any breast in which atrophic or early proliferative changes were present in the lobules.

#### CLINICAL FEATURES

Bilateral involvement of the breast, whether associated with comedoma titis or some other disease was common. Although a total of 163 benign breasts were examined, there were but 110 patients. Each breast was considered as a separate pathologic entity and such viewpoint has been continued in the presentation of the clinical features. Twenty seven of the women underwent simultaneous or consecutive bilateral amputation for comedoma titis. Thirteen had clinical mastitis in the opposite breast at the time of examination and 6 of the 13 had undergone excision of a portion of that breast. Nine patients had undergone mastectomy for some type of benign lesion, 2 had undergone mastectomy for papilloma, 10 had undergone radical mastectomy for cancer and 1 had undergone mastectomy elsewhere by means of application of a "paste" for suspected malignancy. Three others had had comedoma titis associated with cancer in the opposite breast. Sixty five had had a clinically normal breast on the side opposite that of the operation.

Patient in the focal early group had had more trouble with other form of disease of the breast than had those in the other groups, even though fewer of them had bilateral comedoma titis, while in contrast patients in the diffuse advanced group more frequently had had bilateral comedoma titis and less frequently had suffered from other forms of disease of the breast. The absence of previous cancer in this latter group may be significant.

All of the patients in this series were white women. Their ages ranged from 28 to 75 years at the time the breasts were removed with an average age of 45 years. The ages by groups were as follows: sectional early, 43.3 years; sectional advanced, 43.3 years; focal early,

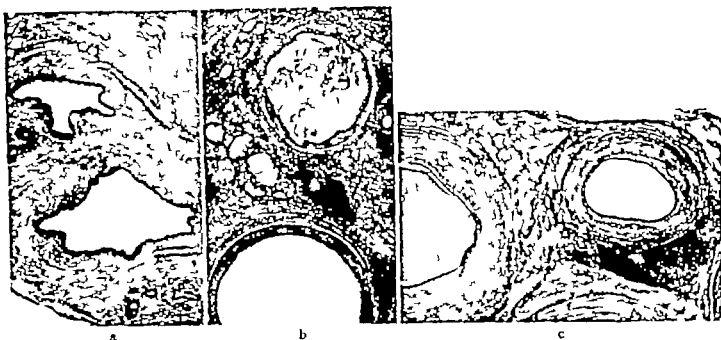


Fig. 6 a, Early comedomastitis with mild periductal retraction although the ducts are considerably dilated. Note also the increase in fibrosis of the stroma.  $\times 27$  b, Advanced comedomastitis with marked ductal distention, periductal inflammation and periductal fibrosis. This spec-

imen also shows the typical appearance of the retained secretion.  $\times 27$  c, In this specimen of advanced comedomastitis is clearly demonstrated the heavy rings of connective tissue that sometimes form about the dilated ducts.  $\times 18$ .

47.9 years focal advanced 53 years diffuse early 44.5 years and diffuse advanced 43.6 years. These figures do not permit the assumption that the disease progresses in degree and severity with increasing age. Fifty three of the breasts were from postmenopausal women while 30 were from women who gave a history of menstrual irregularities which were usually associated with the menopause. These irregularities were especially frequent in those with focal early disease. Thirty three of the breasts had never been subjected to the stimulus of pregnancy and lactation. Only 4 nulliparas had advanced disease. This was in contrast to the high incidence of milder forms of disease in nulliparas and indicates that the stimulative changes associated with pregnancy and lactation may predispose to the development of advanced comedomastitis. Although there was a higher incidence of familial cancer in patients with the early stages of the disease no significance was attached to this finding.

**Symptoms** An attempt was made to determine the principal symptom and its duration. If one judges the onset and duration of the disease from the time of onset of the principal symptom one finds that those patients

with the diffuse advanced disease had a shorter clinical course than those with other forms. It may be that comedomastitis in itself is relatively silent until the inflammation becomes severe enough to draw attention while those breasts with cysts are likely to have lumps or pain which draw attention before the less noticeable comedomastitis has developed fully.

A lump in the breast was described in a higher proportion of those patients with advanced disease than in those with early disease. The term 'discomfort' was used to include any unpleasant or painful sensation from itching to excruciating pain whether constant intermittent or cyclic. Because of this interpretation this symptom was the most common and it was present in a great majority of patients. The occurrence of discharge in 33.3 per cent of those in the diffuse advanced group appears significantly larger than that of 21.8 per cent for the diffuse early and 27.9 per cent for the focal early groups. When a purulent type of discharge was present it was described as gray green orange or brown. More than half of those patients with a history of abnormality of the nipple had marked comedomastitis. Of those with diffuse advanced disease 6.7 per cent had noticed a

change in the nipple. Of the 6 with congenital inversion of the nipple 4 had severe disease throughout. The majority of nipple changes were in those breasts in which there were atrophic or early proliferative changes.

No particular emphasis was placed on a history of injury to the breast although 6 of the women did give this information. Not one of the patients directly related her difficulty to the trauma. No determination of the number of lactations or of the duration of each could be made from the case records. Abnormalities of lactation were noted in 10.4 per cent of the breasts and in more than half of these breasts advanced disease was noted. Of those with prolongation of secretion the discharge remained milky in one but became purulent in the others. Frequent episodes of nonpuerperal mastitis could be expected in this disease and the incidence was 14.1 per cent. It was the most common in those patients with the diffuse advanced disease although the difference was not as great as might be anticipated.

**Signs** The term 'nodularity' was used to apply to those breasts described as granular or shotty or as giving evidence of mastitis or thickening. The breasts so designated made up the largest single group, being especially frequent in association with diffuse early comedomastitis. The diffuse advanced group exhibited a great tendency to have a single mass and every breast of this class had some palpable physical finding. In only 2 cases were palpable ducts described as such. There was but little difference in the total number of cases, type of discharge or distribution as to groups previously defined between the cases in which a discharge was expressed from the nipple at the time of examination and those in which a discharge had been noted by the patient. More nipple abnormalities were found by the medical examiner than had been complained of by the patient, but the same trends as to distribution in the three groups were present. More than half of the deformities occurred in association with diffuse advanced stages of disease. Conversely in 37.8 per cent of patients with diffuse advanced disease lesions of the nipple were present.

Induration, edema, redness, or heat were the signs of inflammation although the occurrence

of induration alone was not considered sufficient evidence. These findings could be expected with marked comedomastitis and in more than half of the instances they were associated with severe disease. Whenever fixation of a mass to the skin or nipple is determined on examination malignancy must be considered and the occurrence of such fixation in 22.7 per cent of the entire series was remarkable. The rate was even higher (33.3 per cent) when diffuse advanced comedomastitis alone was considered. No detailed endocrine studies were carried out. In 14 cases some hormonal imbalance was indicated when routine examinations disclosed diabetes mellitus, hypogonadism, hirsutism, myxedema, low basal metabolism without myxedema and hyperthyroidism. Sixty-four of the breasts were from women exhibiting some type of pelvic abnormality.

Those breasts in which some kind of complication developed caused few symptoms or signs that were at variance with those to be expected from the groups to which they belonged. In 3 out of 4 cases of severe comedomastitis with congenital inversion of the nipple multiple complications occurred. In those cases in which there was periductal hemorrhosis no increase in frequency of bloody discharge occurred. In only 2 of the 5 cases in which microscopic abscesses occurred were clinical signs of inflammation present. Only 3 of those breasts that showed changes suggestive of secretory activity had spontaneous discharge from the nipple and another had a serous secretion on examination. These changes were not necessarily residua of lactation as the colostrum like cells appeared in the breast of one nulliparous single woman. The 2 breasts with subepithelial inflammation were from women with sore nipples.

**Diagnosis and treatment** Often the diagnosis of a breast lesion on clinical grounds is expressed in a broad inclusive term and a specific diagnosis must await the pathologist's examination of tissue. The diagnosis of comedomastitis was made preoperatively but twenty-one times although the condition was probably recognized more often and it was included in 64 other cases under the term "mastitis." That comedomastitis may simulate malignancy was only partly illustrated by the

13 cases in which a diagnosis of carcinoma had been made. Many of those called "tumors" (24 cases) and Paget's disease' (2 cases) were considered "suspicious."

All of the breasts were removed surgically. In 19 of the cases simple excision was considered sufficient to eradicate the involved parts or to prove benignancy. The great majority of the operations consisted of simple mastectomy but in 2 cases the lesion imitated carcinoma so closely that radical mastectomy was performed.

#### COMMENT

Retention of secretion dilatation of the ductal system and periductal mastitis have been shown to be the principal pathologic characteristics of comedomastitis. It appears that the process starts with stasis of the ductal contents with resultant distention. As the more liquid part of the secretion is absorbed the contents become concentrated and viscid. With decomposition or infection irritative substances are produced and inflammation of the ductal walls and periductal tissues results. Complications may develop that lead to abscess formation or to the extensive subacute inflammation of plasma cell mastitis. A subsidence of the more acute phases is followed by fibrosis and hyalinization of the periductal connective tissues so that the irritant medium is effectively walled off from sensitive tissues. A breast with relatively mild changes could be fairly rapidly changed into one showing marked disease by the introduction of infection or by the erosion and rupture of a duct so as to allow the escape of highly irritant secretion into the areolar tissue. One would expect that the ducts which are the site of extensive periductal mastitis would progress to the stage of fibrosis and hyalinization but in some instances inflammation is resolved with few traces remaining and the breasts return to a stage that is represented by that of the diffuse early group. If for some reason the factor that produces dilatation of the ducts ceases to operate and drainage of the system takes place a diffuse ectasia might be wholly or partially relieved so that the breast would fit the criteria for the focal early classification or the tissues might even re-

turn to normal. There is no reason to believe that some of the breasts considered in the present study had not been through this cycle in whole or in part. Some of those in the focal early category which were associated with a history of purulent discharge, nonpuerperal mastitis or abscess may have had a severe inflammation that left little trace. However, in those with the pathologic changes of severe chronic inflammation resolution could hardly be expected to occur.

The sequence of events as just described seems logical and all stages can be seen. To determine the cause of the stasis is more difficult. It may result from obstruction of the ductal system and retention of normal secretion from increased formation of secretion in excess of the amount that the normal mechanism can eliminate or from a combination of the two. Endocrine imbalance and abnormalities of development may account for the process.

In the cases of comedomastitis in this study there was evidence of obstruction of the mammary ducts. In 6 cases congenital inversion seemed sufficient to impair drainage. These women were unable to nurse and pregnancy increased the chance of trouble. Apparently the remaining 22 patients with inversion or retraction had acquired deformities which were a result of the inflammatory process within or around the ducts rather than the cause although such deformity once acquired would tend to interfere with drainage and increase the stasis already present. The one breast with absence of the nipple was diseased before ablation was done. Inflammation beneath the nipple could cause stasis, but, once again the stasis is more likely to be an effect. The incidence of some type of abnormality of the nipple in diffuse advanced comedomastitis was 37.8 per cent and it may be that the majority of the lesions were made worse by the deformity even though the deformity was not the primary cause.

The scarring subsequent to trauma could impede outflow, but no definite connection could be shown in the present study. Inflammatory tissue may occlude the lumina or produce scarring in the stroma of sufficient degree to cause obstruction. Of the 23 instances of nonpuerperal mastitis only 3 definitely pre-

ceded the comedonastitis while the remaining 20 were more likely a result of the disease and were to be expected in the natural course of comedonastitis. The 3 breasts associated with a history of lactation abscess and the 5 in which a tender lump had developed in association with lactation may have been the sites of inflammatory or sclerotic changes sufficient to block the ductal system.

While the ducts near the nipple would be the logical site for obstruction a similar effect might be obtained by blockage of many smaller ducts distally. Such blockage might account for some of the scattered focal lesions and might even be responsible for a few lesions of the diffuse types. Expanding lesions of the breast, especially cysts and also fibroadenoma and fibrosarcoma could block adjacent and distally located ducts by compression. Intra ductal tumors will frequently produce dilatation of the duct distally with retention of secretion and periductal mastitis but the instances of hyperplasia found in this series were mild and seemed insufficient to be causal.

Theoretically extramammary pressure from improperly fitted or improperly worn garments could obstruct the normal outflow of the ducts. Large pendulous breasts drag and may distort the ductal system. We have no evidence that either of these was a factor.

Excessive secretion or desquamation will overburden the normal capacity of the ductal system to discharge its contents. Both occur during and immediately after lactation and lactation does apparently have some influence on the development of comedonastitis. Few nullipara have severe disease. The poor drainage associated with inverted nipples has already been considered. The 5 patients in whom a tender lump developed in the breast either during lactation or immediately after its cessation may have had inflammation, overproduction of secretion or both. In 4 breasts a prolongation of the secretory activity occurred after nursing had ended.

The presence of colostrum like cells in the peripheral ducts and vacuolated or desquamating epithelium or both behind the nipple was probably indicative of secretory activity although further studies and special staining would be necessary to prove this. Similar find-

ings have been described in association with chronic cystic mastitis and with a disease similar to comedonastitis (14 27 33 52). In the present study the secretory action if any, did not seem to increase the stasis as stasis occurred more frequently in the mild forms of the disease. The inflammation associated with development of severe ductal lesions could obscure or destroy the evidences of secretory activity but these evidences seemed more closely associated with cystic disease or apocrine epithelium.

There were evidences of cellular activity in response to irritation in almost all of the specimens examined as most of them showed areas of thickening of the epithelium and some increase in shedding. In the 12 breasts that showed excessive hyperplasia there was an increased amount of desquamation. Infection such as a chronic lactation mastitis might have initiated the triad of stasis dilatation and periductal inflammation by distention of the duct with exudate as well as by obstruction of the normal outflow. However when the inflammatory exudate was a response to the irritants of decomposing secretion it could not be considered as the primary cause although the invasion of the lumen of the duct would have augmented the severity of the disease already present.

Atrophic changes in the breast resulting in ectasia of the ducts and retention of secretion are an etiologic factor in older women. Some authors (9 27) have said that these degenerative changes are primarily responsible for a disease similar to comedonastitis, but others (26 37 54) have found this disease in the breasts of younger women which have not undergone atrophic changes and which have presented a variable pathologic picture as was observed in the present study.

The excellent work that has been done on the hormonal influences in diseases of the breast indicates that endocrine glands may control the development of any type of lesions in the breast. In this series there was inadequate evidence of endocrine dysfunction but the occurrence of comedonastitis at the time of life when endocrine disorders are common may be an indication that it is secondary to some type of abnormal hormonal stimulation. The dia-

tation of the ductal system that is produced in animals by the administration of estrin is similar to that which occurs in the early stages of comedomastitis

#### RELATIONSHIP OF COMEDOMASTITIS TO OTHER DISEASES

*Chronic cystic mastitis* Comedomastitis frequently is inseparably bound to chronic cystic mastitis in the present study. 144 of the 163 breasts contained macroscopic cysts apocrine epithelium or early proliferative changes in the lobules. Often the diagnosis of chronic cystic comedomastitis was made to express the true situation. Indeed in many of the focal early cases the comedomastitis was overshadowed by the cystic and apocrine changes. The presence of cystic disease in the breast may explain why there is a lower average age and a shorter clinical course in cases of advanced comedomastitis than in cases of early comedomastitis when one might expect from the pathologic picture the reverse to be true. Chronic cystic mastitis may also account for the presence of masses discharge from the nipple retraction or inflammation in the breast which is the site of mild scattered comedomastitis. A truer picture of what can be expected clinically from comedomastitis might be obtained from a study of the diffuse advanced group alone.

The intimate relationship of comedomastitis and chronic cystic mastitis may be explained on the basis of etiology. The stasis of secretion in the ductal system may be the inciting factor in production of either. Many authors have observed dilatation of the ductal system in cystic disease and the cysts themselves are usually considered as enlargements of the smaller tubules or acini while comedomastitis involves the larger ones. Why one breast produces cysts and another dilated ducts is not known although the influence of senile involution or residual postlactation ductal enlargement or inflammation would tend to give comedomastitis. The localized changes of the disease can be secondary to the production of cysts which compress adjacent ducts. Time may prove that the two types are responses to different hormones.

*Mammary carcinoma* The etiologic significance of stasis of secretion within the ductal system in the production of neoplasm within the breast has been stressed (2-4, 14, 18, 25, 30, 34, 57). It was stated that the breakdown products of this material were irritant and that they led to epithelial proliferation. The work (56) showing that oleic acid can serve as an activator for mild carcinogens is suggestive. Analysis of retained secretion by Lepper and Weaver showed it to be principally fat with some breakdown products of protein while Adair and Bagg found lactic and butyric acids in thick creamy discharges from the nipple. Most of these investigators have stated that chronic cystic mastitis is precancerous, and the work carried out in studies on animals corroborates this viewpoint (50).

Others (9, 26, 27, 54) said that there was no relationship between the occurrence of lesions similar to comedomastitis and the development of malignancy. When they described cases of marked retention of secretion they found no associated cancer even though cancer was found in another portion of the same breast. In most of those breasts in which neoplastic changes occurred the dilatation of the ducts with retention of secretion was considered incidental to malignant change.

In our series while we were procuring specimens of comedomastitis every case in which that diagnosis had been made was included, and it was found that 23 of the breasts contained concurrent papilloma and 18 contained carcinoma. The presence of the tumor was the only differential point in the gross pathologic appearance. Although the comedomastitis was less advanced and the incidence of hyperplasia was much higher when neoplasia was associated the changes in the ductal system were of the same order as in the benign series. Breasts which contained cysts or apocrine epithelium or both formed the large majority of the cancerous group. The possibility that most carcinomas associated with comedomastitis arise from the ductal system as comedocarcinoma was suggested by the finding of comedocarcinoma in 5 cases and comedo areas in 5 of the infiltrating growths.

The tendency to bilateral disease of the breast was present although it was less definite



in the cases in which papilloma was present. One patient had bilateral comedomastitis and papilloma and another had bilateral comedomastitis and carcinoma. In 3 patients, the remaining breast was removed for benign comedomastitis subsequent to a radical operation for comedomastitis and cancer of the opposite breast. All of the patients with bilateral disease of the breast had cysts or apocrine epithelium or both. Although the youngest patient aged 16 years was in the group with papilloma, the average age in these cases of malignant disease was slightly higher than that in the benign series; however the difference was not as great as one might have expected if the comedomastitis had been primary and the neoplasia had supervened. The duration of the clinical disease indicated that the disease in those patients with neoplasms had a slightly longer time in which to develop; however this determination was made from the time of onset of the principal symptom which was usually associated with the tumor. The incidence of nulliparity is much higher in cases of comedomastitis associated with papilloma than it is in cases of comedomastitis associated with carcinoma. In turn the incidence of nulliparity in cases of comedomastitis associated with carcinoma is slightly higher than it is in cases of benign comedomastitis. There was more familial carcinoma in those patients with neoplasia. The clinical features were predominantly those of the presence of the tumor mass. Little evidence of the comedomastitis was present. There was nothing to indicate that the comedomastitis antedated the neoplasia. Indeed, the reverse may have been true because neoplastic changes may have caused obstruction of the ducts and an increase in desquamation.

In comedomastitis, retention of secretion occurred in the most extensive degree, and while the stages of the disease were not definitely fixed, they were a good indication of the degree of stasis and of the amount of irritation and inflammation that occurred. Instead of the most advanced forms of the disease being found in association with neoplastic changes, the reverse was true. The irritant quality of the secretion was obvious from the amount of inflammatory infiltrate and the epithelial

thickening that occurred to some extent, in all but the cases of earliest comedomastitis, but hyperplasia sufficient to give cell massing and branching forms was infrequent in the benign cases and occurred then only in those breasts that presented other evidence of a growth stimulus in the form of cystic changes or apocrine epithelium. The hyperplasia that was found in association with neoplasia was much more exuberant and much more common than that which was not associated with neoplasia. There was no correlation between the stage of the comedomastitis and the extent or incidence of this overgrowth. There were fewer breasts with atrophic or early proliferative changes in the carcinoma series than in the series with nonmalignant lesions.

No additional cases of early carcinoma arising in comedomastitis were found. Two cases that were originally considered carcinoma could not be verified as such in our section. None of the malignant areas could be traced directly to origin in a focus of comedomastitis. Indeed there was no indication that progression or prolongation of comedomastitis led to an increase in hyperplasia or neoplasia or both. It may be that the ductal lining is resistant to the proliferative stimulus as Geschickter suggested. Apparently neoplasia, when it occurs along with comedomastitis, has a different inciting agent from that of comedomastitis.

*Plasma cell mastitis.* Ewing (24) commented on plasma cell mastitis that 'the main gross anatomic feature is the presence of many such thickened ducts which are filled with puriform material and may extend over a large segment or the whole of the breast. In other descriptions (1 19 20 39 41 45) the presence of large ducts with retained secretion has also been given as an important feature of this disease. Others (27 33 57) have stated that there is a close relationship between plasma cell mastitis and comedomastitis or a disease similar to comedomastitis.

Examples can be found that show every stage in the development of plasma cell mastitis from comedomastitis. In some of the cases of comedomastitis subacute or chronic inflammation about the ducts, presumably due to the leakage of ductal content into sensitive periductal tissues may be evident. In these

cases may be found giant cells foam cells and plasma cells. One patient with bilateral breast disease illustrated the transition very well. In the breast on one side there was typical cell mastitis, while in the opposite breast there was comedomastitis which varied from mildness in some areas to severity in other areas as evidenced by the presence of granulation tissue which contained plasma cells foam cells and foreign body giant cells. In other breasts of the series subacute inflammation and even pseudotubercles were present, but these lesions were considered those of comedomastitis.

It cannot be stated from this study that plasma cell mastitis is invariably the result of comedomastitis but it does seem to be a stage in the same disease process.

**Traumatic fat necrosis** Traumatic fat necrosis as described by Lee and Adair may be related to or identical with some forms of comedomastitis. There is similarity in appearance. Foote and Stewart expressed a belief that some changes associated with stasis and periductal mastitis fit the picture of traumatic fat necrosis. Cole stated that fat necrosis may be identical with plasma cell mastitis if there is minimal liquefaction of fat. Rodman and Ingleby stated that plasma cell mastitis infected galactocoele, traumatic fat necrosis and lactation mastitis are all parts of the same process.

**Fibroadenoma** There was no indication that fibroadenoma had direct connection with any of the cases of comedomastitis aside from the action of any tumor in obstructing adjacent ducts. One case has been reported (37) in which fibroadenoma associated with dilated ducts was found in a breast similarly affected.

**Other diseases** Cases described as chronic galactorrhoea chronic lactation mastitis and so forth may be variations of cases of comedomastitis in some instances, but they do not appear to be identical.

#### CONCLUSIONS

- 1 Comedomastitis is a disease characterized by stasis of secretion dilatation of the ducts and periductal mastitis
- 2 The clinical features of the disease vary widely but the disease may be suspected in the presence of a history of abnormality of

lactation nonpuerperal mastitis, discharge from the nipple or abnormality of the nipple. On examination the lesion may closely simulate carcinoma because of the indurated, fixed mass and retracted nipples.

3 Comedomastitis usually is associated with chronic cystic mastitis which may overshadow it clinically.

4 Neoplasia, although it occasionally occurs in the same breast as does comedomastitis, is probably not related to the latter etiologically. By simple obstruction of the mammary ducts such neoplastic changes may at times produce a focal comedomastitis.

5 Plasma cell mastitis is probably a form of comedomastitis.

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# RESULTS OF TREATMENT OF CARCINOMA OF THE OVARY WITH DATA ON THE AGE INCIDENCE OF THIS DISEASE

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A REVIEW of the literature on malignant epithelial tumors of the ovary leaves some doubt as to the value of roentgen therapy in this disease. Most of the previously reported series of cases show little if any benefit as a result of such therapy. Most authors have recommended that x ray treatments be given as a palliative measure in the more advanced cases. They have admitted that the dosage given to many of the patients was less than optimum as judged by present standards.

It is unfortunate that in the majority of cases the disease is of an insidious nature and that in most hospitals the operability rate is less than 40 per cent. It is also unfortunate that even for those patients judged operable at the time of exploration the cure rate is distressingly low. It appears obvious, therefore that the proper treatment for carcinoma of the ovary has not yet been found.

Walter Bachman and Harris in 1941 reviewed the literature up to that time and reported a series of cases from Mount Sinai Hospital in New York. Of 63 cases of all stages of the disease in which surgery was the only form of treatment 24 per cent were alive at the end of 1 year and only 6.3 per cent at the end of 5 years. Of 31 patients treated by means of surgery followed by adequate roentgen therapy 87 per cent were alive at 1 year and 29 per cent at 5 years. At first glance one may be inclined to discount their figures since the group receiving roentgen therapy contained a smaller number of advanced cases than did the group having surgery alone. However their figures may be further subdivided to show that for the cases judged operable and having surgery only the 5 year salvage rate was 21 per cent whereas the operable group in which patients had surgery plus roentgen therapy showed a salvage rate

of 40 per cent. Of the advanced cases in which patients had surgery alone none was alive at 5 years whereas similar cases in which patients received postoperative x ray treatment showed 18 per cent survivals at 5 years. It thus appears that the chance for survival was definitely increased when postoperative x ray treatments were given.

The same authors believed that histological grading played a minor role in prognosis and that the extent of the disease was of much greater importance. They concluded that x ray therapy was of real value in the treatment of ovarian cancer and that the surgeon should not take too great risks in an attempt to remove the last fragments of diseased tissue but should instead rely on postoperative roentgen therapy.

Other authors (3, 4, 8, 9) have reported series of 100 or more cases with 5 year survival rates which vary from about 15 to 35 per cent. Within these groups of cases there has undoubtedly been some variation in the type of material seen in the interpretation of the histology and in the vigor with which postoperative radiation was given. The highest survival rate appears to be that of Lynch who reported 35.5 per cent in a group of 62 proved cases alive and well at 5 years. He refers to 2 cases in which operation was known to be incomplete but the patients lived 13 and 17 years following x ray therapy. He also reports one proved recurrence after 13 years, and calls attention to several cases of long duration in which patients had little or no x ray therapy but in whom peritoneal implants apparently regressed following removal of the primary tumors. Pemberton in 1940 believed that the operation should be as radical as circumstances would permit and should be followed by x ray treatment. Taylor and Greeley in 1942 were able to show little or no improvement in their

survival curve by giving postoperative radiation but believed it probable that in an occasional case x ray therapy was an essential factor in producing cure.

The group of cases which we wish to report shows a salvage rate which is no higher than that already reported by other authors. We do believe however that adequate x ray therapy may be of very real value to these patients and that it may occasionally be curative. We therefore find ourselves in partial disagreement with Meigs (4 5 6) who believes that x ray therapy has never cured patients but it has helped to make them live longer.

We wish to report the series of patients seen in the department of roentgenology of the New England Deaconess Hospital during the 10 year period beginning in June 1936. The series consists of 76 patients 57 of whom have now been followed to death. Of the original group 14 were alive more than 5 years after their first operation and treatment but 3 of the 14 have since died of their disease and one is alive at 5½ years with recurrent disease. Not all of the patients have as yet had an opportunity to live 5 years after treatment but the 5 year survival rate calculated by the method of Nathanson and Welch is 21 per cent.

It comes as no surprise to find that the 2 patients having stage 1 disease are alive and apparently well 7½ and 8 years following treatment. Of much greater interest are those who survived more than 5 years in spite of the fact that when first seen their disease was too extensive to permit complete surgical removal.

Such a patient was first operated upon in another hospital where large masses had been found in both ovaries. Multiple smaller nodules were scattered through the pelvis and in the general peritoneal cavity where there was a large amount of exudate. The fluid had been removed and a biopsy done. Histological examination had shown papillary cystadenocarcinoma. She was then seen by Dr. E. M. Daland who referred her to us for x ray therapy. She was given 1900 roentgens to each of two anterior and two posterior pelvic ports with 1500 roentgens to each of two upper abdominal ports. Ports measured 15 by 15

centimeters and all treatments were given at 400 kilovolts with other factors as noted below. About 6 weeks later she was again operated upon. On this occasion there was no evidence of disease outside the pelvis and there was no abnormal amount of peritoneal fluid. Ovarian tumors were still present but were smaller than at the time of the first operation, and were removed. Another period of 6 weeks was allowed to pass and she was then given a second series of x ray treatments. These treatments were given through the six ports first used and with the same factors. The last treatment was given on September 30, 1938. Since that time she has been well except for gradually increasing evidence of radiation damage to the skin and subcutaneous tissues. In May 1946 it was necessary to excise an area over the sacrum and replace it with a graft. There is still no evidence of recurrent ovarian tumor.

Six other patients in the group of 14 survivors have received equally large amounts of treatment to the pelvis but in only 2 others has treatment been given to the upper abdomen. Their skin and subcutaneous tissues show varying degrees of atrophy and telangiectasia but only the one has so far required excision and graft. No patient in the surviving group has had less than 1800 roentgens to each of four pelvic ports.

In each case an effort was made to plan the treatment so that all diseased tissue would be included within the ports. If operation had shown the disease to be confined within the pelvis the treatments were given through two anterior and two posterior pelvic ports. In all except very small women the ports measured 15 centimeters square in order to be sure to include the entire pelvic cavity. In previously untreated patients the ports were usually directed straight through the pelvis. Except in the aforementioned case a second or third course of treatments was not given unless there was objective evidence of residual or recurrent disease. If such disease became manifest in the form of a discrete mass, the subsequent treatment was usually directed toward it through ports which would crossfire the mass, and when such a mass seemed to be confined to one side of the pelvis it was usually

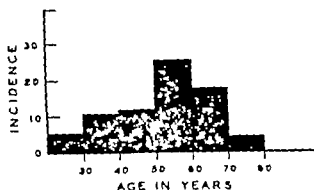


Fig. 1. Series incidence of 74 cases of carcinoma of the ovary

treated through anterior posterior, and lateral ports

If operation had shown the tumor to involve the general peritoneal cavity as well as the pelvis treatments were planned for four pelvic ports and two upper abdominal ports, provided the general condition of the patient would permit such an extended series. In such cases the four pelvic ports were treated first and the upper abdominal ports were the ones which were omitted if it became necessary to stop the series before the entire plan could be carried out.

When the disease was far advanced and exudate was the chief problem treatments were usually given through four anterior abdominal ports. Such ports usually measured 15 centimeters square and were frequently tilted slightly toward the midline in order to conform to the contour of the abdomen.

The original plan of treatment almost always called for 1800 roentgens (measured in air) per port whether or not the beams were crossfired but modifications of the plan were frequently required as the series progressed. Treatments were given at 400 kilovolts with 50 centimeter target to skin distance and with a filter of 0.9 millimeter tin, 0.25 millimeter copper and 1.0 millimeter aluminum. The normal daily dose was 300 roentgens to a single port, and treatments were given daily except Sundays.

The group of patients in whom long term survival was not secured were frequently benefited in a palliative sense by x radiation. Illustrative of that group was a woman who had been operated upon elsewhere 7 years previously because of carcinoma of the ovary

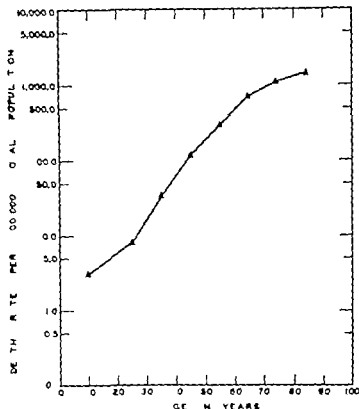


Fig. 2. Death rate for cancer of all types in Massachusetts for 1930. The curve quickly goes off the page unless a semi-logarithmic scale is used.

When seen by us there was a hard mass which extended upward to the level of the umbilicus and there was a large amount of peritoneal exudate. Paracentesis had been necessary every 10 to 14 days during the recent past because of the rapid production of the fluid. She was given 1800 roentgens to each of four anterior abdominal ports and did not require paracentesis thereafter. The mass persisted in spite of a second series of treatments which was given 7 months later through four pelvic ports. She died 14 months after her first series of treatments.

#### AGE INCIDENCE

During the course of study of this group of cases we wished to know whether or not the age of the patients was in any way unusual. Figure 1 was therefore constructed in order to show the number of patients afflicted during each decade of life. At first glance the chart did not appear in any way unusual, and it was obvious that the largest number of patients were in their sixth decade when the diagnosis was made. The number of persons under 30 years of age was approximately the

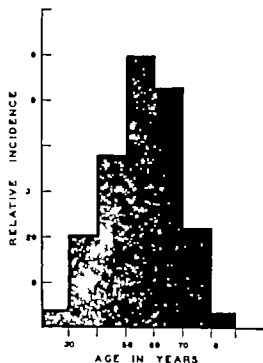


Fig. 3. Age specific incidence of 494 cases of carcinoma of the ovary

same as the number of those over 70 years old.

The chart was then corrected in order to take into account the number of females living in Massachusetts in each decade of life. The greatest frequency for the disease was again in the sixth decade and although the incidence over age 70 was then approximately eight times the incidence under age 30 it was still only about one third the incidence of the sixth decade. The series was admittedly small for any study of age incidence but the apparent decrease in rate after age 60 was of considerable interest, since the age specific death rate (and incidence) for most types of cancer rises sharply with advancing years. The age specific death rate for cancer of all types in the United States for 1940 was 61 per 100,000 persons living between the ages of 35 and 44 years, 369 per 100,000 between 55 and 64 years, and 1,183 per 100,000 for persons over 75 years of age (9). These rates are almost identical with those computed for Massachusetts for 1930 (1). Organ specific rates have also been computed from Massachusetts data for cancer of the breast, uterus,

urinary bladder, skin and buccal cavity. In each case the rate rises steadily with advancing years although the rate of rise varies independently for each organ.

We are not aware of previously published data concerning the age specific incidence of carcinoma of the ovary. The records of 430 histologically proved cases have been consulted in addition to those of the 74 proved cases already noted. The age recorded is that at the time when the patient was first seen because of the ovarian cancer. A total of 135 cases are from the Palmer Memorial unit of the New England Deaconess Hospital, 89 from the Peter Bent Brigham Hospital, 154 are from the Massachusetts General Hospital and 126 from the Pondville State Hospital for Cancer. The figures for the Massachusetts General Hospital and the Pondville State Hospital were kindly obtained for us by Drs. J. V. Meigs and Langdon Parsons. Figure 3 shows the incidence by decades for the group.

#### SUMMARIES OF CASES SURVIVING 5 YEARS

**CASE 1.** Panhysterectomy was performed in a patient aged 53 years. A tumor which involved primarily the right ovary and extended a loop of bowel was resected followed by x-ray treatment consisting of 1800 roentgens through 4 pelvic ports. Patient was well 7 years.

**CASE 2.** Panhysterectomy was done in a patient of 34 years. Implants were noted throughout the pelvis and abdomen. She was given 1800 roentgens through 4 pelvic and 2 upper abdominal ports. She was well 6 years.

**CASE 3.** Patient aged 30 years had an exploratory laparotomy elsewhere 5 months previously. Mass on wall extends to umbilicus. At second operation tumor was found adherent to both lateral walls of the pelvis. Gross disease known to be left behind where it enveloped ureter. She was given 800 roentgens through 3 large pelvic ports. Eighteen months later she was given 3000 roentgens through 4 pelvic ports because of a tender mass on left. Eight months later she was given 1500 roentgens through 4 pelvic ports plus 1500 roentgens through a left lateral port. Seven years after first treatment she began to have trouble with a rectal stricture evidently due to irradiation. Colostomy was done 1 year later. She died 9 years after the first operation.

**CASE 4.** Patient aged 48 years had had a panhysterectomy elsewhere in 1926 for presumed benign cystadenomas. In 1937, a mass adherent to the bladder, sigmoid and pelvic walls was excised. The mass is now histologically malignant. X-ray therapy consisted of 3000 roentgens through 4 pelvic ports. Patient was well 9 years.

CASE 5 Patient aged 45 years had had a panhysterectomy. It was found that a tumor had invaded the uterus and was adherent to the pelvic wall. She was given 1100 roentgens through 4 pelvic ports. Patient was well 6 years.

CASE 6 Patient aged 39 years had been operated upon elsewhere in 1929 for a malignant papillary tumor of the ovary. Roentgen therapy had been given elsewhere in 1932. Patient was first seen at New England Deaconess Hospital in 1939 when she presented a tender mass in right side of pelvis. She was given 1800 roentgens through 4 pelvic ports. Two years later a colostomy was done elsewhere because of obstruction of the colon. There was an extensive tumor in the pelvis but none was seen in the upper abdomen. She was given another course of 1500 roentgens through 4 pelvic ports. She died 15 years after the first operation. 5 years after the first treatment by us.

CASE 7 Patient aged 43 years was operated upon elsewhere 7 years previously for papillary adenocarcinoma. When seen at New England Deaconess Hospital she presented a mass with exudate. Examination of the fluid revealed tumor cells. She was given 1800 roentgens through 4 abdominal ports. No further fluid was found but the mass persisted. Seven months later she was given 1800 roentgens through 4 pelvic ports. She died 7 months later. 8 years after operation.

CASE 8 Patient aged 59 years had had a panhysterectomy. A tumor adherent to the pelvic wall and rectum was found. Roentgen therapy consisted of 1800 roentgens through 4 pelvic ports. She was well 7 years.

CASE 9 Patient aged 53 years was given 1800 roentgens through 4 pelvic ports following panhysterectomy. She was well 8 years.

CASE 10 Patient aged 34 years had had an exploratory laparotomy but only biopsy specimens were taken. Implants were noted throughout the pelvis. She was given 1800 roentgens through 2 large pelvic ports. Three months later she was given 1800 roentgens through 4 abdominal ports. Five months later she showed persistent mass in the pelvis and was given 1500 roentgens through 4 pelvic ports plus 600 roentgens through 2 lateral ports. One year after first operation panhysterectomy was accomplished in spite of dense adhesions. Histological examination of tissue showed malignant papillary cystadenoma with radiation reaction. Patient was well 7 years after operation.

CASE 11 Patient aged 31 years was given 1800 roentgens through 4 pelvic ports after a left oophorectomy. She was well 8 years.

CASE 12 Patient aged 43 years had had an exploratory laparotomy elsewhere which revealed large masses in each ovary and smaller nodules elsewhere. Abundant fluid was present. Biopsy was done. She was given 1800 roentgens through 4 pelvic ports plus 1500 roentgens through 2 upper abdominal ports. At second operation masses were removed followed by the administration of 2000 roentgens through 4

pelvic ports plus 1500 roentgens through 2 upper abdominal ports. A radiation ulcer over sacrum was excised 7½ years later. No evidence of residual tumor was found.

CASE 13 Patient aged 60 years had had a panhysterectomy. A mass was adherent to the pelvic wall. She was given 1800 roentgens through 4 pelvic ports. Treatment was repeated 4½ years later because of the presence of a mass in right side of the pelvis. She was alive but with residual disease at 5½ years.

CASE 14 Patient aged 39 years had had a panhysterectomy. Multiple implants were noted in the pelvis. She was given 1800 roentgens through 4 pelvic ports. Treatment was repeated 4 months later. She was well 9 years.

### CONCLUSIONS

We believe that x ray therapy should be employed in all cases of carcinoma of the ovary that it is excellent insurance post-operatively even when the surgeon believes that all disease has been removed and that it may occasionally result in cure even in advanced stages of the disease.

We believe that the surgeon should not take too great risk in his attempt to remove the last fragments of diseased tissue but that he should remove the easily accessible masses and then rely on x ray therapy in adequate dosage and through whatever ports may be necessary to cover the involved areas.

X ray therapy may bring about gratifying palliation even when cure is not obtained. It often gives relief of pain and causes a retardation of the production of peritoneal and pleural fluids.

The age specific incidence of cancer of the ovary is unlike that of most other types of malignant epithelial tumors since it falls after the sixth decade.

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# STREPTOMYCIN IN THE SURGERY OF PULMONARY TUBERCULOSIS

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THE medical sections of the Veterans Administration the Army and the Navy have been conducting a co-operative study of the bacteriostatic action of streptomycin on the tubercle bacillus. This study has presented American medicine with a unique opportunity. Never before has such a wealth of clinical material and trained medical personnel been immediately available for research on a new therapeutic agent.

The surgical divisions of the 47 participating study units were asked to determine whether streptomycin provides any protection against postoperative spread or reactivations and against the development of empyema in patients subjected to thoracoplasty and pulmonary resection for tuberculosis.

The program was initiated in January 1947. After that date every alternate patient subjected to thoracoplasty and every patient undergoing lobectomy or pneumonectomy was given streptomycin as a protective agent. It was felt that the use of controls in resection cases could not be justified under present conditions. The experience of leading clinics in this country had demonstrated that the mortality and morbidity rate following such procedures was so high as to be almost prohibitive. Six hundred resections for tuberculosis have been reported in the American literature since 1933. Five hundred and twenty of these have been performed since 1943. The total mortality rate in this group was 25 per cent. Empyema followed in 12 per cent of the operations and bronchopleural fistula occurred in 8 per cent. It was considered that these reports offered a sufficient background of experience with which to compare the streptomycin treated patients. If the drug were of value it would seem mandatory to use it in every patient undergoing resection in an effort to brighten this rather gloomy picture.

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Thoracoplasty on the other hand has become standardized by several generations of thoracic surgeons and in recent years has been accompanied by few complications. The number of spreads or reactivations reported in series from the larger thoracic surgical centers has varied between 3 and 6 per cent with empyema a rare complication. The use of controls was considered essential to the study.

In the beginning 2.0 grams of streptomycin per day were given by intramuscular injection divided into 5 doses. On October 15, 1947 the standard daily dose was reduced to 1.0 gram divided into 2 doses of 0.5 gram each at 12 hour intervals. This reduction in dosage was made as a result of experience gained in the larger study of pulmonary and extrapulmonary tuberculosis of which this surgical investigation constituted a part. It was desired also to avoid, as far as possible the development of resistance to the drug. Resistance had been shown to develop rather uniformly after 6 to 8 weeks of treatment. Under both regimens the drug was administered for 1 week before and 2 weeks after each operation. Since the usual interval between thoracoplasty stages was 3 weeks and the number of stages per patient averaged 3 continuous administration of streptomycin for 9 weeks has been the rule in the thoracoplasty series.

The operating surgeons in each of the member groups were designated or approved by the Veterans Administration Central Office. A further condition of the study was that the indications for operation should not vary from those in use at the respective clinics before streptomycin was employed.

An analysis of the individual reports from the contributing groups indicated that thoracoplasty operations had been performed in 28 hospitals. The number of patients operated upon at each hospital varied from 1 to 99. In both the treated and control groups, 1,347 stages of thoracoplasty were performed.

In the group of streptomycin treated patients 699 operations were performed upon 258 patients. Postoperative spreads or reactions resulted in 14, the majority of which were actually reactivations of pre-existing disease. Fifty per cent of the 14 occurred after the first stage. Thus spreads followed thoracoplasty in 2 per cent of the operations in patients treated either with 20 grams or 10 gram of streptomycin daily. In this group there were 8 wound infections or 1.1 per cent.

In the group of control or untreated patients there were 249 who underwent 648 operations. Among these there were 36 spreads or reactions reported. Wound infection occurred following 16 operations. Expressed in terms of per cent spreads occurred in 5.6 per cent and wound infections in 2.4 per cent. In all respects except for the use of streptomycin, these groups were handled in a similar manner.

A reduction in the occurrence of spreads from 5.6 to 2.0 per cent by virtue of streptomycin protection in a consecutive series of 1347 thoracoplasty stages would seem a logical conclusion to be drawn from this study. If correct it certainly is of statistical significance. Analysis of the reports from the individual hospitals however indicate that in some of the larger centers, no such discrepancy between the groups of treated and untreated patients occurred. Some of those clinics were able to demonstrate that in the years prior to the discovery of streptomycin postoperative spreads had been held to a comparable figure.

There remains, however, a definite impression that streptomycin will make it possible to accept for operation many patients in whom the disease is too widespread or of too unstable a character to permit a thoracoplasty without its protection.

These facts were considered by the entire Conference<sup>1</sup> and a decision was reached to discontinue the streptomycin study insofar as it pertained to thoracoplasties. The consensus was that the reported reduction in spreads was significant but that other factors such as improvement in anesthesia and surgical techniques and in preoperative and postoperative care as reported by some member groups

<sup>1</sup>Fifth Veterans Administration Streptomycin Conference, meeting in Chicago, Ill., April 15-18, 1948.

TABLE I.—COMPLICATIONS IN PULMONARY EXCISIONS TREATED WITH STREPTOMYCIN

	No. of Patients	Spread	Bronchopulmonary fistula	Empyema	Wound infection	Deaths	
						Operative	Nonoperative
Lobectomy Treated 2.0 gram	34			1	0	0	1
Treated 1.0 gram	43		3	2			
Pneumonectomy Treated 2.0 gram	20			3			0
Treated 1.0 gram	3			1			0
Total	100	8	3	6	3		0

might have influenced the results. It was agreed to permit each surgeon to continue the use of streptomycin in cases which in his judgment were questionable risks but in which the operation was necessary if the disease was to be controlled.

In the pulmonary resection group the results in patients operated upon with streptomycin protection were so superior to all those previously reported as to leave little room for doubt as to its value.

There were 129 resections performed: 77 lobectomies and 52 pneumonectomies. Sixty-three of these patients were given 20 grams of streptomycin daily divided into 5 doses; 66 were given 10 gram daily, divided into 2 doses. The results as shown in Table I indicate that the 10 gram is as efficacious as the 20 gram dose.

Fifty per cent of the patients have had a postoperative follow up of from 6 to 14 months. It is far too early to make other than a preliminary estimate of sputum conversion, but the figures reported indicate that concentrated specimens of sputa are negative to date in 73 per cent of these patients. There were 3.1 per cent of these patients with question-able character. Bronchopulmonary fistulas followed 5.7 per cent of the operations and empyema 4.0 per cent. There were 5 operative and 1 nonoperative deaths, a mortality rate of 4.5 per cent.

A reduction of the mortality rate accompanying lobectomy or pneumonectomy for

tuberculosis from 25 per cent, as reported in the immediate pre-streptomycin era, to 4.5 per cent in a large series of streptomycin treated patients is of tremendous significance. The reduction in occurrence of postoperative empyema from 12 per cent to 4 per cent is also dramatic. While other factors pertaining to anesthesia, surgical technique, and postoperative care may have aided in these results the fact seems unquestionably established that streptomycin has made resection for pulmonary tuberculosis feasible and reasonably safe.

In addition to the thoracoplasty and pulmonary resection groups, there were reported 8 open pneumonolyses 8 decortications 10 extrapleural pneumonolyses with lucite ball plombage and 12 cavernostomy closures in all of which streptomycin was used as prophylaxis. There were no spreads or other serious complications reported among these patients. The number of operations reported from any one unit was not large enough to be of statistical significance. The favorable results so far reported however indicate that the use of streptomycin may be extended to any thoracic surgical operation for tuberculosis, in which the possibility of spread, empyema, or fistula presents a threat to the success of the surgery.

#### DISCUSSION

This study seems to indicate that streptomycin has a protective action against spreads following thoracoplasty for tuberculosis. The operation of thoracoplasty however had become so standardized and the complications so few in the pre streptomycin era that this fact is difficult to establish unequivocally. Since the development of resistance to the drug is common after 6 weeks of treatment, it was felt that the degree of protection obtained was not of sufficient value to warrant its routine use. If a resection should be required at a later date the resistant patient would be at a distinct disadvantage since there is experimental evidence which suggests that treatment in a

resistant patient may be injurious. The majority of participating surgeons at the Conference were of the opinion that thoracoplasty can be performed by virtue of streptomycin protection on a few patients who would have been rejected because of the exudative character of their disease if the drug were not available.

There was unanimous agreement that the use of 10 gram of streptomycin daily for 1 week before and for 2 weeks after resection should be continued without the use of alternate controls. The reduction in mortality rate and in the frequency of occurrence of postoperative spreads empyemas and bronchopleural fistulas offers apparently incontrovertible evidence of the protective action of streptomycin in pulmonary resections for tuberculosis.

#### CONCLUSIONS

- 1 The results of a co-operative study concerning the protective action of streptomycin in 1,347 thoracoplasty stages and 129 pulmonary resections for tuberculosis are presented.

- 2 Streptomycin should not be given to the routine thoracoplasty patient but should be reserved for the occasional borderline risk patient in whom the disease is more widespread and more exudative in character than is usually considered suitable for surgery.

- 3 The use of streptomycin before and after operation in every pulmonary resection for tuberculosis is considered mandatory.

NOTE.—The information contained in the report of "Streptomycin in Surgery of Pulmonary Tuberculosis" represents the combined efforts of a large group. The accumulation of these data could not have been accomplished without the unselfish co-operation of bacteriologists, internists, and surgeons, guided by expert statisticians.

Since Dr. Murphy was actively engaged in this project and had a significant personal series, he was asked to prepare the combined report.

This endeavor may well serve as a model for future combined research projects.

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# THE LUMBOSACRAL ARTICULATION

## A Roentgenologic and Clinical Study with Special Reference to Narrow Disc and Lower Lumbar Displacement

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SINCE the early investigations of Goldthwait on the anatomy of the lumbosacral articulation in its relationship to low back and sciatic pain, numerous observers have recorded their findings which have emphasized the importance of this anatomic area in patients with these complaints. The studies of Von Lackum revealed the vulnerability of the lumbosacral area to trauma and degenerative change. Danforth and Wilson described the relationship between the lower lumbar nerves the intervertebral foramina the lumbosacral facets and the lumbosacral disc in the etiology of sciatic pain. Ayers reported the frequency of narrowed fifth lumbar intervertebral disc in patients presenting the sciatic syndrome. Williams expressed the opinion that the fifth lumbar disc was narrow in the majority of cases of sciatica and frequently in so called lumbago. Badgley, reporting a large series of patients with sciatic pain noted narrowing of the fifth lumbar disc in 57 per cent. All of these and many other observers felt that the disc narrowing was due to developmental traumatic and degenerative changes and that there was frequently associated displacement of the lumbosacral articular facets, with degenerative changes in the cartilage of the facets and narrowing of the intervertebral foramina. Ferguson however denies any relationship between narrow lumbosacral disc and the incidence of sciatic pain. Barr and Mixter state that a narrow lumbosacral interspace occurs about as frequently as other congenital abnormalities and should be considered as an incidental finding unless there is associated sclerosis or spur formation. Willis noted narrow disc in only 7.6 per cent of a series of patients with back and leg pain. Some writers described congenital narrowing of the disc while others attributed such obser-

vations to the presence of transitional vertebrae, the immature disc being mistaken for the true lumbosacral disc. Posterior protrusion of the disc, noted very early by Goldthwait and receiving widespread attention following the studies of Schmorl has been associated by many writers with the narrowed appearance of the disc as noted on the roentgenogram.

Anterior displacement of the fifth lumbar vertebra on the sacrum, usually associated with a defect in the interarticular portion of the neural arch has been well described by Neugebauer Junghanns Meyer Burgdorff, and many others. An excellent résumé by Chandler emphasizes that the cause of the cleft in the neural arch and of the forward displacement is as yet undetermined. Numerous observers have recorded the relationship between this condition and the development of low back and sciatic pain. Spondylolysis spondylolisthesis and potential spondylolisthesis are the terms used to designate a defect in the arch without forward slipping. Pseudo-spondylolisthesis is meant to convey forward displacement without defect in the neural arch and presumably due to anomalous articular facets or developmental abnormality in the arch of the fifth lumbar vertebra characterized by prolongation without interarticular defect.

More recently a condition of posterior displacement of the fifth lumbar vertebra on the sacrum so called reversed spondylolisthesis has been described by Smith Johnson, Williams Ferguson, and Haggart. These observers have noted the condition to exist frequently in patients with low back and sciatic pain and consider it a common lesion associated with anomalous development or degenerative change of the lumbosacral articular facets and often with narrowed lumbosacral disc.

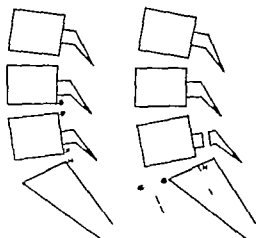


Fig. 1. Schematic drawing of lumbosacral articulation. a, left, Usual relationship fifth lumbar and sacrum. b, right, Anterior displacement fifth lumbar vertebra with defect in neural arch.

The existence of this condition has however been vigorously denied by Willis on the basis of anatomical studies. He believes that the appearance on the roentgenogram is always due to the larger anteroposterior diameter of the fifth lumbar vertebra which creates on the film the optical illusion that it is posteriorly displaced on the sacrum. In skeletons, in 66 per cent of a series of 50 cases the diameter of the fifth lumbar was greater than the sacrum and in the remainder the measurements were equal. Willis feels that this is an anatomic variation and of no clinical significance. His views are shared by many clinical observers so that the existence of this entity remains controversial.

#### PURPOSE

In view of the continued difference of opinion relating to the importance of narrowed fifth lumbar disc and displaced fifth lumbar vertebra in the etiology of backache and sciatic pain, a study of a large series of roentgenograms was made with the purpose of establishing the incidence of these conditions. The group of patients whose roentgenograms were reviewed presented themselves for study chiefly because of back and leg complaints. There was, however, a relatively small number whose lumbosacral films were made not for backache but because of pelvic and abdom-

inal conditions vague extremity complaints and general disorders in which bone changes were suspected. Only one requirement was imposed—satisfactory anteroposterior and lateral lumbosacral films with a spot lateral in which the central rays passed directly through the lumbosacral joint. Five hundred such films were examined and the authors knew nothing about the reasons for roentgenographic study so that there were included both cases with back and leg pain and also a group with neither of these symptoms.

After determination of the incidence of narrowed lumbosacral disc and displaced fifth (and fourth) lumbar vertebrae the patients showing these changes on the roentgenograms were studied clinically to determine their principal complaints and important physical findings in the hope that this would throw some light on the importance of these roentgenographic changes. One hundred eighty-one cases were so studied. For comparison the clinical findings of the 319 patients whose films showed no displacement or narrow disc were also reviewed.

#### ROENTGENOLOGIC STUDY

The method of investigation of the true lateral roentgenograms is demonstrated diagrammatically in Figures 1 and 2. The anterior and posterior fourth lumbar disc measurements are designated by *AC* and *BD* respectively while these measurements for the fifth lumbar disc are represented by *EG* and *FH*. The anteroposterior diameters of the fifth lumbar and first sacral segments are measured respectively as *EF* and *GH*. Anterior displacement of the fifth lumbar vertebra measured at the posterior border is represented by *H H* whereas posterior displacement measured at the posterior border is *III*. In a previous article one of the authors (EAB) in the study of a series of roentgenograms of backache and control cases established an arbitrary minimum normal posterior fifth lumbar disc measurement as 5 millimeters. In this series all fourth or fifth lumbar posterior disc measurements less than 5 millimeters were considered narrow. Other observations from the true lateral views were the incidence of lumbosacral arthritis flattening of the lumbar spine, and

increased lumbar lordosis. Defects in fifth lumbar neural arch were observed and recorded.

In the anteroposterior lumbosacral films, transitional lower lumbar vertebrae were not ed together with other lumbosacral anomalies such as separate neural arch and spina bifida occulta. Immature horizontal or grossly abnormal lumbosacral facets were recorded in their relationship to fifth lumbar displacement. When a transitional lower lumbar vertebra was observed on the anteroposterior film care was taken to avoid measuring the transitional disc on the lateral view as the lumbosacral disc. When a sacral vertebra was completely lumbarized, the sixth lumbar disc was considered the lumbosacral. When a fifth lumbar vertebra was completely sacralized the fourth lumbar disc was considered the lumbosacral. In cases of partial lumbarization or sacralization, the disc immediately above the transitional vertebra was considered to be the lumbosacral. Although we did not have films of the complete spine and there may have been occasional error due to uncertainty as to which vertebra was the first lumbar it is felt that the error was minimal and certainly in no case was a transitional lower lumbar disc recorded as a narrow lumbosacral disc. The authors are furthermore well aware of the obvious lack of precision in the measurement of roentgenograms especially since there is always some slight difference in positioning and technique. However, it is felt that this lack of precision is well distributed in the large series and from the practical point of view can be disregarded in the interpretation of the roentgenologic findings.

#### Statistical Study of Roentgenograms

**Narrow disc** Of the five hundred roentgenograms there was definite narrowing of the fifth lumbar disc at the posterior margin in 132 (26.4%). The fourth lumbar disc was narrowed posteriorly in 18 (3.6%). The latter was associated with narrow fifth lumbar disc in 13 (2.6%).

The relative size of the fourth and fifth lumbar discs was studied. In the case of the anterior disc measurements the fourth lumbar was greater than the fifth in 184 (36.8%), it was less than the fifth in 256 (51.2%) and the

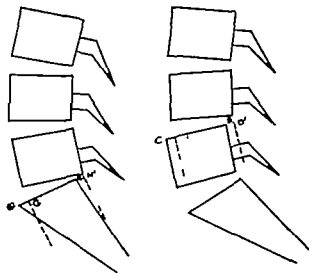


Fig. 2. Schematic drawing of lumbosacral articulation. a, left, Posterior displacement fifth lumbar vertebra and narrowed fifth lumbar disc; b, right, posterior displacement fourth lumbar vertebra.

measurements were the same in 60 (12.0%). In the case of the posterior disc measurements the fourth lumbar was greater than the fifth in 388 (77.6%), it was less than the fifth in 54 (10.8%), and the measurements were the same in 58 (11.6%).

Figure 3 shows the relative size of the fourth and fifth lumbar disc measurements. On the average,  $AC$  is somewhat less than  $EG$  but  $BD$  is considerably greater than  $FH$ . This would tend to show that there is a greater strain placed at the lumbosacral joint than in the region of the fourth lumbar articulation and might be one of the factors in the greater incidence at this point of strain, degenerative change, narrowed intervertebral foramina and

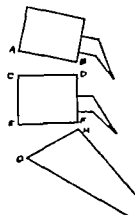


Fig. 3. Schematic drawing of lumbosacral articulation showing difference in fourth and fifth lumbar disc measurements and possible relationship to the frequency of lumbosacral pain.  $AC < EG$   $BD > FH$   $AC:BD$  2.5:1  $EG:FH$  3.4:1

possibly posterior disc protrusion. In support of this hypothesis an average of the fourth and fifth lumbar disc measurements in the series shows that the relationship between AC and BD is 2.5 to 1 whereas the relationship between EG and FH is 3.4 to 1.

#### *Displacement of Fifth Lumbar Vertebra*

Displacement of the fifth lumbar vertebra occurred in this series in 76 (15.2%). Of these cases 32 (42.3%) were associated with narrow fifth lumbar disc.

Posterior displacement of the fifth lumbar occurred in 51 (10.2%). Of these 24 (43.1%) were associated with narrow disc. Anterior displacement of the fifth lumbar occurred in 25 (5.0%) and of these 8 (32.0%) were associated with narrow disc.

Anterior and posterior displacements were measured at both the anterior and posterior edges. In this series the average anterior displacement of the fifth lumbar vertebra at the anterior edge was 5.0 millimeters (L 16 S 2) while at the posterior edge it was 5.4 millimeters (L 14 S 2). In the case of posterior displacement of the fifth lumbar the average posterior displacement at the anterior edge was 2.2 millimeters (L 5 S 0) while at the posterior edge it was 4.6 millimeters (L 8 S 2).

*Anteroposterior diameters.* In considering the general question of displacement of the fifth lumbar vertebra, the relative depth of the fifth lumbar and first sacral segment was studied. In the entire series the anteroposterior diameter of the fifth lumbar was greater than that of the first sacral in 236 (47.2%) while it was less than the first sacral in 112 (22.4%). The measurements were the same in 152 (30.4%).

In cases showing posterior displacement of the fifth lumbar vertebra the diameter of this vertebra was greater than that of the first sacral in 47 (92.2%) less than the first sacral in none, and the same in 4 (7.8%).

In cases showing anterior displacement of the fifth lumbar vertebra the diameter of this vertebra was greater than the first sacral in 6 (24.4%) less than the first sacral in 14 (56%) and the same in 5 (20%).

It will be noted that in posterior and anterior displacement of the fifth lumbar vertebra,

there is a reversal of the relative number of cases in which the anteroposterior diameter of the fifth lumbar is greater than that of the first sacral. In the cases with posterior displacement the percentage of these cases is approximately twice that of the entire series, whereas in anterior displacement it is approximately half that percentage.

*Apparent cause of displacement.* Because it has been suggested that difference in anteroposterior diameters of the fifth lumbar and first sacral segments might account for the appearance of posterior displacement (and also presumably for some cases of apparent anterior displacement) each film showing anterior or posterior displacement was carefully evaluated from this point of view. Only the posterior edges were used in this evaluation because measurement of displacement at the anterior edge is extremely inaccurate and it has been shown by Ferguson that there is anterior slipping and compensatory increase in anteroposterior diameter of the first sacral segment as a result of the abnormal pressure on the anterior sacral edge in spondylolisthesis.

Comparison was made between the difference in anteroposterior diameters of the fifth lumbar and first sacral segments and the amount of displacement as measured at the posterior edge of these segments. If the difference in diameters was exactly the same as the amount of displacement it was assumed that the appearance of slipping was due to the difference in diameters alone. If there was no difference in diameters the amount of displacement was assumed to be a true forward or backward slipping. If there was a difference of diameters but this was not as great as the amount of displacement, it was assumed that the displacement was due to a combination of difference in diameters and true forward or backward slipping.

In cases with posterior displacement the difference in diameters alone could account for the apparent displacement in 10 (19.6%). Posterior slipping alone was the apparent cause in 4 (7.8%) while a combination of the two factors was noted in 37 (72.6%).

In cases with anterior displacement the difference in diameters alone was the apparent cause in none. Anterior slipping alone was re-



Fig 4 Roentgenogram of anterior displacement fifth lumbar vertebra. Lateral view showing defect in neural arch



Fig 5 Anterior displacement fifth lumbar vertebra. Lateral view with no defect in neural arch. Oblique views also showed no defect

sponsible in 11 (44 %) while a combination of the two factors was noted in 14 (56 %) in stances

#### *Fifth Lumbar Arch Defects*

Since it is a common observation that there is almost always a defect in the interarticular portion of the fifth lumbar neural arch to account for anterior displacement while no such logical explanation can be given for posterior displacement the presence of such defects was observed and recorded (Fig.4) It is also conceivable that either anterior or posterior displacement might be due to anomalies or degenerative changes in the lumbosacral articular facets.

In the 25 cases of anterior displacement of the fifth lumbar vertebra, a definite defect in the neural arch was noted in 21 (84%) In none of these cases was anything unusual not

ed in the lumbosacral facets In 3 cases (12%) no break in the arch was observed but since no oblique views of the lumbosacral area were available in these cases it must be assumed that the defect might have been revealed by such views In only 1 case (4%) was there definite anterior displacement with no defect on any of the lumbosacral views despite repeated examination (Fig 5) This case did show immature lumbosacral facets

The anterior edge of the sacrum was studied in these cases of anterior displacement to note the presence of anterior lipping and spur formation It was felt that this factor might account for the increased percentage of cases in this group which showed the anteroposterior diameter of the first sacral segment to be greater than that of the fifth lumbar In 11 cases (44%) definite anterior spur formation was noted





Fig. 5. Posterior displacement of fourth lumbar vertebra, lateral view. There is a slight anterior displacement of the second, third and fourth lumbar vertebrae.

In the cases of posterior displacement the cause was investigated from the appearance of the lumbosacral articular facets. In only 5 cases (10%) was there any suggestion from the roentgenogram that immature horizontal or completely internal-external facet might be the basic factor in the displacement.

#### Fourth Lumbar Displacement

Displacement of the fourth lumbar vertebra was noted posteriorly in 13 (26%) (Fig. 6) and anteriorly in 2 (4%). This was noted in association with fifth lumbar displacement in 8 (16%). The average anterior displacement at the anterior edge was 4 millimeters (L 5 S 3) and at the posterior edge was 4 millimeters (L 5 S 3). The average posterior displacement at the anterior edge was 2.2 millimeters (L 5 S 0) and at the posterior edge was 3.8 millimeters (L 5 S 3). The anterior cases were



Fig. 6. Anterior displacement of fourth lumbar vertebra. There is a definite break in the neural arch of the fourth lumbar vertebra.

accompanied by a definite break in the neural arch of the fourth lumbar vertebra.

#### Lumbosacral Region

*Incidence.* The total cases with lumbosacral anomalies consisting of transitional lower lumbar vertebrae, spina bifida occulta, defective neural arch, and immature articular facets were 105 (33%).

Transitional lower lumbar vertebrae were noted in 60 (13%). Of these cases there was an associated narrow lumbosacral disc (narrow immature transitional disc) in only 9 (15%). Complete lumbarization was noted in 1 (4%) and partial lumbarization in 35 (76%). Complete sacralization was present in 7 (14%) and partial sacralization in 1 (2%).

The other lumbosacral anomalies were noted in 112 (22.4%) and of this number 16 (14.3%) were associated with transitionals and 30

(26.8%) were associated with narrow fifth lumbar disc.

**Arthritis** Definite arthritic changes were noted at the lumbosacral articulation in 36 (7.2%). Of these 25 (70%) were associated with narrow fifth lumbar disc (Fig. 7).

Of 181 cases with narrow disc or lower lumbar displacement 27 (15.0%) had lumbosacral arthritis. This was present in only 2.8% of the other cases in the series.

**Curve** There was definite loss of the normal lumbar curve in 62 (12.4%). It is noteworthy that in the 51 cases of posterior displacement of the fifth lumbar vertebra the lumbar curve was flat in 16 (31.4%) whereas in anterior displacement it was flat in only 1 case (.4%). Of the cases with flat lumbar spine there was associated narrowed fifth lumbar disc in 21 (34.0%).

Of 181 cases of narrow disc or displacement, 27 (15.0%) had flat lumbar spine. This was present in 11.0% of the other cases.

Increased lumbar lordosis was noted in 16 (3.2%). In the cases with anterior displacement of the fifth lumbar vertebra increased lordosis was present in 3 (12.0%) while in posterior displacement it was noted in none. Of the cases with increased lumbar lordosis there was associated narrowed fifth lumbar disc in 4 (25%).

Of 181 cases of narrow disc or displacement 8 (4.4%) had increased lordosis. In the other cases it was found in 2.5 per cent.

#### CLINICAL STATISTICS

The clinical records of the patients were examined after the roentgenographic findings had been recorded. Most of the patients had been seen by the senior author in consultation and his clinical findings noted on the records.

There were 181 patients (36.2%) whose roentgenograms showed narrow fifth lumbar disc displacement of the fourth or fifth lumbar vertebra or a combination of these findings. There were 319 patients (63.8%) whose films showed none of these changes. The latter will be referred to as the control group.

The patients were chiefly adult males. There were 176 (97.3%) between the ages of 21 and 60. Only 1 patient was under 21 years and 4 were over 60 years.



Fig. 8. Posterior displacement fifth lumbar vertebra, lateral view. The slight difference in anteroposterior diameters of the fifth lumbar and first sacral segments only partially accounts for the amount of posterior displacement.

#### Incidence of Back Pain

Of the entire series of 500 patients, backache was present in 405 (81.0%), there was associated leg pain in 145 (29.0%) and neither of these complaints was recorded in 95 (19.0%). In no case was there leg pain alone, although in a few the complaint of hip pain was interpreted as backache.

Of the 181 patients with narrow disc or lower lumbar displacement backache was present in 153 (84.5%) and there was associated radiating leg pain in 53 (29.2%). In 28 (15.5%) neither of these complaints was present.

In the control group backache was present in 252 patients (79%), there was associated leg pain in 92 (29%) and in 67 (21%) neither complaint was noted.

Conversely there were in the entire series 260 patients with back pain alone. Of these



Of 132 cases with narrow fifth lumbar disc 23 (17.4%) had no complaints. Of 51 cases with posterior displacement of the fifth lumbar 3 (5.9%) were without back or leg pain and of 25 cases of anterior displacement 2 (8%) did not make these complaints. Of 15 cases of displacement of the fourth lumbar vertebra all presented symptoms of backache with or without leg pain.

**Diagnosis** It is noteworthy that in 20 patients (13.6%) no definite orthopedic diagnosis could be made to account for the patient's back and leg complaints. In the control group, there was failure in diagnosis in 67 (26.6%).

Of the 153 patients with such complaints 61 (40.5%) were thought to have some form of arthritic change, 50 (32.7%) were thought to have a localized muscular or ligamentous strain and 16 (10.4%) were diagnosed as a lower lumbar posterior disc protrusion. Other diagnoses were made in 6 (3.9%). There were 4 cases in which the complaints were thought to be due to an old spinal osteochondritis, one was due to a secondary lesion from carcinoma of the prostate and one was due to simple contusion.

In the control group 41 (16.3%) were diagnosed as arthritis, 106 (42.1%) as strain, 28 (11.1%) as protruded disc and other diagnoses were 10 (3.9%). A comparison of the clinical findings noted in the group with narrow disc or displacement and in the control group is represented in Table II.

**Disc series** Because a narrowed lower lumbar disc on the roentgenogram is often associated by authors with posterior protrusion of such a disc and the production of clinical signs, the cases in which protruded lower lumbar intervertebral disc had been diagnosed were studied with this point in mind. There were 44 patients on whom this clinical diagnosis had been made. Of these, 33 (75%) were diagnosed by clinical methods and 11 (25%) were confirmed by surgical exploration.

In this group the incidence of narrowed lower lumbar disc as noted on true lateral roentgenograms was 13 (30.0%). Of the cases confirmed by operation 9 revealed protrusion at the fifth lumbar interspace. A review of these films revealed a narrowed fifth lumbar disc in 3 (33.3%). A posterior protrusion of the

TABLE II — ROENTGENOGRAPHIC AND CLINICAL

	FINDINGS	
	Narrow disc or displacement 81 cases Per cent	Control group 30 cases Per cent
Lumbosacral arthritis	15.0	8.8
Flat lumbar spine	15.0	11.0
Increased lordosis	4.4	5.0
No back or leg pain	15.3	21.0
Back pain with or without leg pain	84.5	79.0
Back pain alone	55.3	50.0
Back pain with leg pain	29.2	29.0
Clinical findings	153 cases with back symptoms	253 cases with back symptoms
Associated leg pain	34.6	36.5
Sciatic pain	33.3	31.6
Altered reflexes	9.8	8.7
Limited straight leg raising	19.0	17.8
Body tilt	7.8	5.0
No diagnosis	13.0	20.6
Diagnosis—strain	33.7	42.1
Diagnosis—arthritis	40.0	16.3
Diagnosis—disc protrusion	10.4	11.1
Other diagnoses	3.9	3.9

fourth lumbar disc was revealed at operation in 2 cases. Both of these showed narrowed fifth lumbar intervertebral disc on the roentgenograms.

Of the 44 cases, 6 (13.7%) revealed posterior displacement of the fifth lumbar vertebra. Of the 6 cases with posterior displacement, 3 (50%) were associated with narrowed disc. No case of anterior displacement of the fifth lumbar vertebra was noted in this series.

#### DISCUSSION

Several of the roentgenographic and clinical findings seem worthy of brief discussion. The relationship which has been observed between the fourth and fifth lumbar disc measurements indicates the vulnerability of the lumbosacral articulation to mechanical strain, a point which has been emphasized by numerous observers. Any change in the usual anatomic structure of the lumbosacral joint, such as a narrowed fifth lumbar disc, especially posteriorly, and anterior or posterior displacement of the lower lumbar vertebrae would in all likelihood place additional burden on a point of mechanical weakness and might produce pain in the lower back with or without leg radiation. Whether or not such complaints develop would depend on the ability of the ax-

associated muscles and ligaments to compensate for the exaggerated mechanical strain.

It would appear that posterior displacement of the fifth lumbar vertebra is not uncommon and that it is not usually due solely to a difference in diameters of the fifth lumbar and first sacral segments. The exact cause of such displacement is conjectural and although it is assumed that anomalies of the lumbosacral facets are the basic predisposing factors, the roentgenograms offer no satisfactory evidence for this hypothesis.

Anterior displacement of the fifth lumbar vertebra occurs with half the frequency of posterior displacement and is almost always associated with a defect in the neural arch. In 44 per cent of cases there is compensatory lippling of the anterior edge of the sacrum.

Comparison of the anteroposterior diameters of the fifth lumbar and first sacral segments in attempting to explain the appearance of posterior fifth lumbar displacement on the roentgenogram, reveals that the fifth lumbar diameter in the entire group is greater than the first sacral in approximately 50 per cent. Where there is posterior fifth lumbar displacement, however, the fifth lumbar diameter is greater in about 90 per cent and where there is anterior fifth lumbar displacement it is greater in only about 25 per cent. Since it is known that anterior lippling of the sacrum is present very often in cases of anterior displacement and this might account for greater anteroposterior sacral diameter in these cases it would seem reasonable to consider, in cases of posterior displacement, the possibility of secondary atrophy of the anterior edge of the sacrum which would account for the lessened anteroposterior sacral diameter in this group.

The similarity between the clinical findings in the groups with and without narrow fifth lumbar disc and lower lumbar displacement is most striking. Since the incidence of back pain, leg pain, altered reflexes and limited straight leg raising is the same in the two groups, it would appear that in most cases narrow disc and lower lumbar displacement are not in themselves the cause of symptoms. This is reinforced by the similarity of incidence of narrow disc and lower lumbar displacement in cases with back pain alone, with

back and associated leg complaints, and in cases presenting neither of these symptoms. Only in the case of fifth lumbar displacement is there a different incidence in the groups with and without symptoms.

It is remarkable that the incidence of back and leg pain was the same in the two groups in spite of the fact that there was a much higher percentage of cases with lumbosacral arthritis in the patients with narrow disc and displacement. It might be deduced from this what has often been suspected namely that localized changes noted on the roentgenograms are not necessarily the cause of the patient's complaints. The greater frequency of arthritic change in the one group, however, would tend to confirm the belief that narrow disc and lower lumbar displacement cause increased lumbosacral strain and that such patients are more likely to develop decompensation of muscular and ligamentous structures as the result of acute or chronic trauma than are patients without these anatomic variations.

From the study of cases in which a diagnosis of ruptured nucleus pulposus or posterior disc protrusion was made it is apparent that the incidence of narrow fifth lumbar disc is no greater in this group than in other patients. Such an x ray finding cannot, therefore, be used as clinical evidence of disc protrusion.

From the roentgenographic and clinical data which have been accumulated it would seem that narrow fifth lumbar disc and lower lumbar displacement occur with similar frequency in patients with or without symptoms, that there is no characteristic clinical syndrome which they present and that they are not in themselves the cause of backache and leg pain. However like other lumbosacral anomalies, they may further weaken the lumbosacral articulation and make it even more susceptible to injury.

This study has thrown no light on the etiology of these lower lumbar anomalies. Undoubtedly some are due to congenital defects, some to developmental changes, and others to the effect of acute and chronic trauma, but unless followed by muscular or ligamentous decompensation they are not necessarily productive of symptoms and are of no significant clinical importance.

## SUMMARY

1 In a series of 500 roentgenograms focused over the lumbosacral joint, narrowed fifth lumbar disc was noted in 26.4 per cent, posterior displacement of the fifth lumbar vertebra was present in 10.2 per cent, anterior displacement of the fifth lumbar was present in 5.0 per cent, and there was displacement of the fourth lumbar vertebra in 3.0 per cent.

2 The incidence of back and leg pain in the 181 cases in which these changes were noted was not significantly greater than the incidence of these complaints in the other 319 cases.

3 When the two groups were studied clinically they showed a strikingly similar incidence of alteration in leg reflexes, limitation of straight leg raising and body tilt on forward bending.

4. The clinical diagnoses in the two groups were almost identical. There was however a considerably higher incidence of lumbosacral arthritis in the patients with narrow disc or lower lumbar displacement.

5 A study of the groups of patients with back pain alone with associated leg pain and with neither of these complaints revealed no significant difference in the incidence of narrowed fifth lumbar disc but there was a smaller incidence of lower lumbar displacement in the symptom free group.

6 Posterior displacement of the fifth lumbar vertebra is apparently a definite entity and is not due entirely to difference in anteroposterior diameters of the fifth lumbar vertebra and the sacrum although in about 20 per cent this is apparently the reason for the appearance on the roentgenogram. It is possible that in cases of posterior displacement there is secondary atrophy of the anterior edge of the sacrum which decreases the anteroposterior diameter of the first sacral segment.

7 Anterior displacement of the fifth lumbar vertebra is usually associated with a defect in the interarticular portion of this vertebra and in at least 40 per cent of the cases there is anterior tipping of the sacrum which increases the anteroposterior diameter of the first sacral segment.

8 In cases of herniated nucleus pulposus or posterior disc protrusion, the incidence of nar-

rowed fifth lumbar disc or lower lumbar displacement is not significantly greater than in the remainder of the series. Narrow disc on the roentgenogram cannot be considered clinical evidence of posterior disc protrusion.

9 Narrowed fifth lumbar disc and displacement of the lower lumbar vertebrae are clinically significant only in that these conditions place additional strain on an already mechanically vulnerable lumbosacral joint.

10 The weight of evidence seems to indicate that in most instances narrow fifth lumbar disc and lower lumbar displacement are in themselves not the cause of low back and sciatic pain. As is true in the case of transitional vertebrae and other lumbosacral anomalies the presence or absence of back or leg pain depends almost entirely upon the integrity of the surrounding muscular and ligamentous structures. So long as these structures are intact the patient may be symptom free. When they are no longer able to compensate for the abnormal mechanical strain pain may occur because of tension on muscle and ligamentous attachments, degenerative arthritic changes in the articular facets or actual pressure on the spinal nerves at some point in the region of the deranged lumbosacral articulation.

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# A CORRELATION OF NEUROLOGIC, ORTHOPEDIC, AND ROENTGENOGRAPHIC FINDINGS IN DISPLACED INTERVERTEBRAL DISCS

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ALTHOUGH the number of operations for displaced intervertebral disc has been steadily increasing comparatively few surgeons have published thorough reviews of their postoperative results. There remains considerable difference of opinion as to the precise indications for operation, the most favorable type of operation and whether or not a primary or secondary fusion should be attempted. Most reports have been limited to the problem of subjective improvement of back and sciatic pain and the objective neurologic changes following operation. Some authors have also attempted to correlate the effect of trauma and occupation with the etiology and degree of postoperative improvement (4, 8). Occasional papers have considered the result from an orthopedic or radiologic viewpoint (2, 3).

The purpose of this paper is to present a group of postoperative disc patients who have been critically studied neurologically and orthopedically. The results of these examinations were then integrated with the roentgen findings. In this way we hoped to determine any relationship that might exist between the preoperative and postoperative roentgenograms, the operative findings, and the eventual operative result.

For the purpose of this review a group of 95 postoperative intervertebral disc patients was collected from the Neurosurgical Service of the Hospital of the University of Pennsylvania. This series consisted only of patients operated upon for displaced lumbar intervertebral discs.

The follow up study consisted of a careful physical examination by members of the orthopedic and neurosurgical staffs. This was

followed by anteroposterior and lateral roentgenograms of the lumbar spine and pelvis. Neurologically the patients were examined for sensory motor and reflex changes. The lower limbs were checked for signs of atrophy or weakness and for the presence of pain on straight leg raising. Orthopedically, the patients were examined for any scoliosis, restricted mobility, paravertebral spasm or pelvic tilt. All patients were questioned as to the presence of any residual back pain or sciatic pain. Finally the patients were asked concerning their personal opinion of the operation. Each patient was asked if he was fully satisfied with the results of the operation and the results recorded as 'yes', 'no', or 'questionably satisfied'. The preoperative and postoperative findings were carefully compared and the preoperative and postoperative roentgenograms reviewed by a member of the radiology staff. An attempt was made to correlate the x ray findings with the postoperative physical findings in each case. A special study was made of those patients who were definitely not or only questionably satisfied.

The patients were divided into two main groups of laborers and non laborers, since it was felt that this difference in occupation might have a bearing on the etiology and the result. Also the possibility of trauma was listed in each case. The follow up period varied from less than 1 year to more than 5 years. The patients were divided into four groups as follows: less than 1 year (16 patients), 1 to 3 years (30 patients), 3 to 5 years (32 patients), and over 5 years (17 patients). Postoperative findings at operation were likewise divided into subgroups. Discs were listed as ruptured, protruded or hidden. In the remaining cases findings of hypertrophied ligamentum flavum or negative exploration were listed as such.

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The type of operation seemed an important factor. Accordingly the operations were divided into three groups: laminectomy, hemilaminectomy, and interlaminar dissection.

Indications for operation have varied somewhat over the years since this subject first came into prominence. During the past 4 years, however, we have become more conservative and have felt that the results were more gratifying from both the patient's and our own point of view. We first use conservative therapy in the form of rest and board mattress. Buck's extension for 10 to 14 days follows, and the patient is sent home with a brace or supportive belt. There is a decided advantage if the patient has had several recurrent bouts of severe pain before operation is eventually decided upon. If operation is performed when the patient has little or no back or leg pain, the distress resulting from the operative incision may well make him feel that his condition has not been improved by surgery. But if his pain, particularly his leg pain, has been acute and is promptly relieved by removal of the disc, he is quite willing to put up with the postoperative back pain. He feels that he has been definitely improved by surgery. His attitude with regard to the final operative result is optimistic, a very important factor in obtaining satisfactory relief. Due to this preoperative conservatism, we believe that we have increased both our proportion of ruptured discs found at operation and the percentage of satisfied patients. At present whenever possible the routine disc operation consists of an interlaminar dissection. Postoperatively weight bearing is permitted on the fifth to seventh day provided the patient has a light supportive belt. This we advise wearing for the first 6 weeks to 3 months. It is then to be discarded gradually as the patient increases his activities.

#### ETIOLOGY

The etiology of the displaced nucleus pulposus has remained an interesting question. The preponderance of male sufferers and the percentage of patients with a history of injury suggest a traumatic origin.

Of the 71 males and 24 females comprising the group studied, 56 per cent claimed a traumatic onset.

It is of interest to note that almost as many non-laborers traced their disability to a traumatic incident as laborers. Half of the laborers remembered no one precipitating event.

The operative findings revealed that in the nontraumatic group 21 per cent showed indefinite findings such as hidden disc, hypertrophied ligamentum flavum, or no findings at all compared to only 13 per cent showing such indefinite findings in the traumatic group.

The majority of the patients were in their third and fourth decades, the youngest being 19 and the oldest 63. Patients complained of back pain preoperatively for an average period of 5 years and sciatic pain for an average period of 2 1/4 years.

#### DIAGNOSIS

While the determination of the presence or absence of a ruptured disc depends, for the most part, on physical and neurologic findings, other diagnostic aids are frequently used. In order to ascertain the reliability of some of these aids, a study was made of the spinal fluid protein level, conventional x rays, and myelography.

In 54 patients a spinal fluid protein was determined preoperatively. Forty-eight per cent of the readings were below 50.0 milligrams per cent while 43 per cent were between 50.0 and 100 milligrams per cent. In 9 per cent there were values over 100. These results indicate the doubtful value of the spinal protein in establishing a diagnosis.

The conventional roentgen examination consisted of an anteroposterior projection of the pelvis and lumbar spine and a lateral projection of the lumbar and lumbosacral spine. This type of examination was made in 68 patients preoperatively. In such conventional films preoperative roentgen changes were found in approximately one half of these patients. We do not believe that there is any absolute correlation between such findings and the presence of a displaced intervertebral disc or hypertrophied ligamentum flavum since an equal number of patients in this age group who do not have such disease will show similar roentgen changes. However, appreciable narrowing of an intervertebral space indicates loss

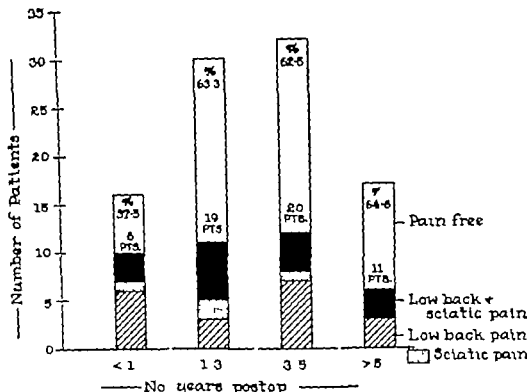


Fig. 1 Relationship of postoperative time interval to back and sciatic pain.

of substance of the disc either by degeneration and absorption or by extrusion. When this is found in a patient with the usual clinical syndrome, we feel that it should be considered as corroborative evidence.

The changes seen in conventional preoperative roentgen examinations in 68 patients are reviewed in the light of operative findings.

Air myelographic studies were made in 15 patients of the series. Opaque myelographic studies were made in 61 patients of the series in 39 pantopaque was used and in 22, lipiodol. At the conclusion of the examination an attempt was made to remove the oil under fluoroscopic guidance in 45 of the 61 patients so examined.

The correlation of air myelograms with operative findings in 15 patients indicates that when a filling defect in the air column was found, surgical exploration was positive. The absence of a defect in an air myelogram, however, could not be considered as conclusive evidence that a lesion was not present.

From correlation of oil myelograms with operative findings in 61 patients it is evident, as others have also shown, that a high degree of accuracy is obtained in oil myelography. In this series a differential diagnosis was not

made between hidden disc, protruded disc, ruptured disc, and hypertrophied ligamentum flavum. The oil myelograms showed defects which appeared similar in these four conditions.

#### RESULTS

As previously indicated, the 95 patients seen postoperatively were divided into four groups for evaluation. The follow up periods ranged from less than 1 to over 5 years. When the patient was asked to evaluate his own result and whether or not he was fully satisfied and would again elect operation for his original complaints, knowing in advance what relief he could anticipate, 83 or 87 per cent of the patients replied in the affirmative. Seven per cent claimed they were dissatisfied, and 5 patients (5 per cent) could not decide. All of the discs operated upon in this series were between the fourth and fifth lumbar or the fifth lumbar and first sacral.

More detailed inquiries showed that there were 38 patients (40 per cent) who had residual or recurrent pain. This pain was not sufficiently incapacitating to invalidate the operation in the opinion of the patient. Complaints varied from occasional mild backache in 18 patients or sciatic pain in 4 to those with both

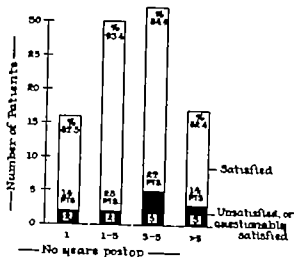


Fig. 2. A comparison of percentage of satisfied patients in various postoperative periods.

low back and sciatic pain present in 16. The largest number of these patients dated the onset of their pain to the operative period. A few claimed a recurrent type of pain originating 1 to 5 years postoperatively.

An analysis of the type of pain in the different follow up groups showed that a large number of low back complaints occurred in the patients most recently operated upon (Fig. 1). Complaints of low back pain associated with sciatic pain remain at a relatively constant level in each group.

Many diverse complaints of a mild nature were noted. Foremost among these was the presence of annoying muscular cramps in the hamstring and calf muscles on the side of the previous sciatica. Other patients noted low thresholds of back fatigue and subjective hyposthenias while a foot drop persisted in 1 patient.

An effort was made to determine which operative procedures gave the best results. Surprisingly enough there was no clear cut statistically significant choice between laminectomies, hemilaminectomies or interlaminar dissections.

Operative findings sharply influence results. Thirty nine out of 58 or 70 per cent of the patients with ruptured discs followed over 1 year were pain free. Four patients (44 per cent) with protruded discs were pain free as were 3 patients (50 per cent) of those with

hidden discs. Conversely there were only 6 patients (9 per cent) not satisfied when operative findings had revealed a definite rupture of the disc. Three patients (27 per cent) of those with protrusions were not satisfied, as were 2 patients (22 per cent) of those with hidden discs and 1 patient (50 per cent) of those with no findings at all. All of the 5 patients with hypertrophied ligamentum flavum were satisfied.

Although the presence of mild episodes of postoperative back pain was common in those patients with ruptured discs there was a low incidence of residual or recurrent sciatic pain. This finding contrasted with a higher incidence of residual or recurrent back pain and sciatic pain in those patients who at operation presented hidden or protruded discs. The possibility of a recurring disc may explain such a return of the original complaint in the protruded and hidden group.

From our studies it appears that absent or diminished tendo achillis reflexes do not often return postoperatively. In 74 instances this reflex was lost or diminished postoperatively on the involved side, and in 5 instances it was lost on the opposite side.

Fifteen among 48 (31 per cent) laborers did not return to their former occupations. They decided that they could not continue in their present work and chose lighter work. Some changed because they did not wish to abuse what they regarded as a weakened back while others changed after a trial at their old job which resulted in pain on doing certain types of heavy work. It is probably true that even a larger percentage than indicated modified their daily work although keeping the same job. Only 4 (9 per cent) out of the 47 non-laborers felt it necessary to seek other jobs. Five years postoperatively 4 patients (23 per cent) out of 17 still wore supports in the form of canvas belts or braces. All of these patients had complaints.

An analysis of the dissatisfied or questionably satisfied patients was undertaken (Fig. 2). One patient had expectations of recovering from a marked foot drop but no improvement in function followed the removal of the ruptured nucleus pulposus. This correlates with the failure of the achillis reflex to return.



Fig. 3 Preoperative and postoperative films showing marked narrowing and early bridging.

Two patients in whom hidden discs were removed complained of mild residual back pain and sciatic pain. The examination of the back was entirely negative in 1 while some restriction of motion was present in the other. Roentgenograms gave no clues to the causes of these complaints.

Three patients of the dissatisfied or questionably satisfied group had a recurrence of severe sciatic scoliosis, spasm of the erector spinae muscles, and limitation of motion together with positive straight leg raising tests. This group might show a recurrence of the original pathology. The remaining patients complained of back pain with little explanation afforded for their complaints by physical examination. One of these patients operated upon 6 years ago with x ray evidence of narrowing of the interspace is relieved by a brace.

*Postoperative roentgen studies.* A study of the changes seen on the conventional roentgenograms made preoperatively and postoperatively and of the clinical status of the patients reveals that there is no significant relationship between increased narrowing of an intervertebral space and the clinical result. Increased arthritic change is seen in almost exactly the same proportion in the three classified groups of clinical results and consequently we feel that no significant relationship exists. Fusion or dense bony bridging between the vertebral

bodies above and below the site of the herniated discs is seen in only that group classified as clinically well. It might be presumed that this constitutes a favorable change. It occurred however, in only 6 of 39 or 15 per cent of the group.

A significant quantity of residual opaque oil was found in 10 of 36 clinically well patients in 1 of 17 clinically improved patients and in 3 of 8 clinically unimproved patients.

#### DISCUSSION

Results of other postoperative disc series vary from 24 per cent to 80 per cent cured (4, 5, 7). The present figure of 60 per cent cure compares favorably with these and emphasizes the difference between a straight neurosurgical clinic series and the cross sectional series of Aitken and Bradford. Their cases were reviewed from the files of a large insurance company and reveal a cross section of operative work done by general surgeons, orthopedic surgeons and neurosurgeons in various clinics throughout the country. They describe their results as excellent (13 per cent), good (17 per cent) and fair (25 per cent). The remaining 45 per cent were graded as 'poor' and 'bad results.' An excellent result they describe as 'no pain and able to return to any type of work.' This appears to be the only result comparable with 'cure' in other disc series.



Fig. 4. Normal preoperative films

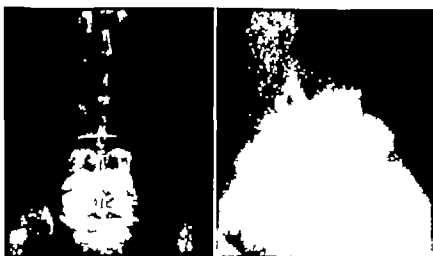


Fig. 5. Postoperative films of the same patient shown in the preceding figure showing narrowing and early fusion.

The results of diagnosis by myelography show the increasing value of this procedure. Begg and Falconer reviewed the myelograms in a series of 86 patients with a disc found at operation. Eighty-eight per cent of these patients showed a positive myelogram for a disc preoperatively while 12 per cent showed

no disc at the third lumbar interspace. They recommended exposure of centrally displaced discs bilaterally. Complete removal of all rupture material and treatment of the remaining disc are essential. The rate of success is 100 per cent.



Fig 6 Preoperative and postoperative films showing narrowing and beginning bony fusion.

15 secondary fusions performed in their series and 9 of these or 60 per cent were able to return to some form of work. Love and Walsh believe that cases with frank spondylolisthesis with ruptured disc at the fifth lumbar—first sacral level usually require a fusion. However, they do not feel that narrowing of an interspace or the presence of spina bifida occulta is an indication for need of fusion. Love, in a recent review of 1,271 postoperative disc patients, questions whether or not fusion of the lumbosacral region causes more stress to be applied at the interspace just above the upper end of the graft with resultant protrusion. In this series he also shows that there is a marked rate of recurrence from less than  $\frac{1}{2}$  per cent at the end of 2 years to slightly more than 5 per cent after 5 years postoperatively.

In a group of 843 patients operated on for ruptured disc by the late Walter Dandy, Lenhard was able to examine 147 in a postoperative follow up. Of these, 23.8 per cent were able to perform their normal activities without complaint. Three types of operation had been employed in this series. Prior to January 1942, to June 1943, curettage or removal of the entire disc was done. After June 1943, multiple discs were recognized and removed entirely. Practically all were done by an interlaminar approach. Analysis of the results showed that there was no relation between the

type of operative removal and the degree of cure. He likewise concluded that there is no relationship between a narrowed interspace and the faulty disc, the disc being found either at the level of the narrowed space or at the space above or below. No fusions were done in this series and no myelograms were deemed necessary since 90 per cent were at the fourth or fifth lumbar interspace. Lenhard feels that some of the patients with residual complaints due to tight muscles or faulty body mechanics could be helped by fusion.

The question of fusion has been closely analyzed by Barr in a series of 234 cases in which patients were operated on for ruptured disc. Of these, 102 had fusion and 132 had been operated upon without fusion. In reply to a questionnaire, the same percentage of each group (10 per cent) complained of severe back pain. Likewise, the same percentage in each group (63 per cent) stated that they were able to do a full day's work. However, there were 60 per cent of the fused group with no back pain and 45 per cent in the non-fusion group without back pain. Likewise, there were 25 per cent in the fused group that complained of leg pain compared to 46 per cent in the non-fused group with leg pain. He concludes that the trend is toward spinal fusion at the time of laminectomy in an increasing number of cases.

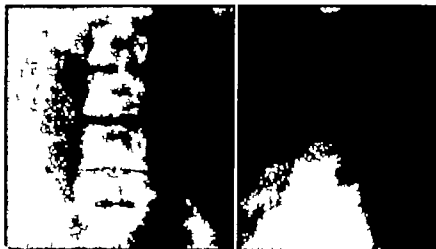


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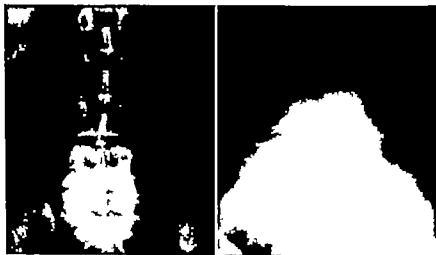


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3 at the third lumbar interspace. They recommend exploring centrally displaced discs bilaterally to be sure of complete removal of all ruptured disc material and to avoid a recurrence. Love and Walsh are of the opinion that clinical diagnosis is just as accurate as myelography although they employ air almost routinely preoperatively. There are no definite conclusions on the subject of primary or secondary fusions following disc operations. Aitken and Bradford report on 39 primary fusions performed in their series. Of these 39 cases 19 or 50 per cent were able to return to some form of work. There were also



Fig 6 Preoperative and postoperative films showing narrowing and beginning bony fusion.

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## SUMMARY

1. A group of 95 postoperative disc patients was studied by the neurosurgical, orthopedic and roentgenologic departments.

2. Sixty per cent of these patients were regarded as cured and were able to pursue a normal full day's work without any back or sciatic pain.

3. Eighty-seven per cent of these patients were fully satisfied with the results of the operation.

4. The factors of age, trauma or type of operation appear to have no relationship to the type of injury. Also the type of operation appeared to be unrelated to the result.

5. Air myelograms while helpful were not as accurate as desired in our experience. Oil myelography, preferably with pantopaque as the contrast medium, is the method of choice and should be routinely employed.

6. The end results will be more gratifying in proportion to the degree of displacement of the nucleus pulposus.

7. Lost or diminished achilles reflexes do not often return nor should a patient be allowed to believe paralyses will invariably recover following successful removal of the offending mass.

8. No relationship between increased narrowing of an intervertebral space and clinical result can be shown. Fusion of the vertebral bodies or dense bridging occurred in 6 patients, all of whom are in the group of clinically well. It could reasonably be postulated that more will develop this change as time goes on but further follow up studies will be necessary to substantiate or disprove this point.

9. It seems unlikely that the presence of a significant quantity of residual opaque oil in the caudal sac has any influence upon the clinical result.

10. The fundamental principle for good results is careful selection of patients with exclusion of those cases that fail to measure up to an exacting history and physical examination supported by myelography.

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# THE MANAGEMENT OF KNEE INJURIES INCURRED IN COLLEGE FOOTBALL

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OF the various insults to which the body of a football player is subjected injuries to the knee are among those fraught with the most serious consequences in terms of permanent disability. The middle aged business man with a trick knee dating from his high school or college football days is commonplace. A considerable proportion of these injuries can be prevented or minimized by proper protective measures and prompt adequate treatment.

The management of knee injuries has been a major concern of the medical staff of the Harvard Athletic Association since the appointment of the first team surgeon 38 years ago. The principles and policies which have evolved from this accumulated experience were first presented by Thorndike in 1938 (12). It is the purpose of the present report to review these principles and policies in the light of another decade of experience and to present the results of their application during the 1947 season to the varsity junior varsity and freshman squads. The 174 men in this group constituted about one third of the players regularly participating in contact sport during the fall season.

The management of any athletic injury is best considered from three points of view: prevention, immediate treatment and diagnosis and definitive therapy.

## PREVENTION

No player is allowed to don a uniform until a history of past illnesses and injuries has been taken and a thorough general physical examination carried out by a physician on the staff of the Department of Hygiene of the University. All old injuries discovered during this procedure are immediately reported to the medical department of the Athletic Association.

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The Department of Hygiene of the University and the Staff  
of the Department of Hygiene of the University, Boston

tion and are reviewed by the team surgeon concerned. Each knee is compared to the opposite knee with regard to quadriceps atrophy, lateral and medial collateral ligament laxity, cruciate ligament laxity, range of motion, and fluid (Fig. 1). Almost invariably roentgenograms are taken. Marked muscular weakness or instability disqualify the player for contact sport. He is instructed in quadriceps and hamstring strengthening exercises and advised to return a year later for re-examination. Those players who present minor degrees of ligament laxity or a history of previous knee injury or operation are strapped with adhesive tape before every practice session and game throughout the season. The method of taping is known as the Duke Simpson strapping after the trainer who first devised it and provides in effect, an extra set of collateral and cruciate ligaments outside the skin. Properly applied (Fig. 3) it produces great lateral and anterior posterior stability with no appreciable interference in flexion or extension. It does not significantly decrease the player's speed. A varsity player wearing full equipment and with a Duke Simpson strapping on both knees was able to run 100 yards from a standing start in 11.8 seconds. Daily taping during a 12 week season is likely to produce skin irritation. Tincture of benzoin compound has been used in the past as a protection before each application of tape, but during the 1947 season a formula devised by Dr. Martin Bellinger was found to be both cheaper and more effective.

Rouge G (powdered)  
Ethyl alcohol  
Iodic foch. in

1 pound (453.6 gm.)  
1 gallon (3785.4 c.c.)  
1 "pinch" (0.15 gm.)

No candidate for the varsity junior varsity or freshman squads in 1947 was rejected because of weakness or instability of the knee. Of the 174 players comprising the squads 31 required daily protective taping. Of these 31 suffered a sprain of the medial collateral ligament during a game and 1 a recurrence of a

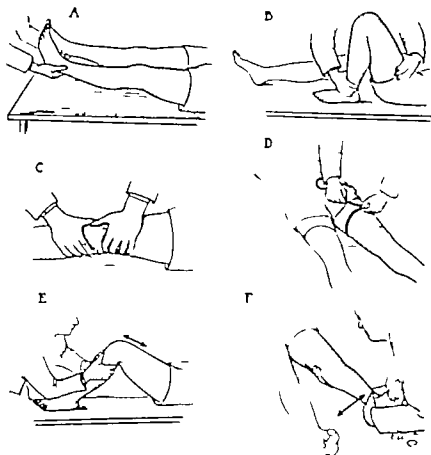


Fig. 1. Basic steps in examination of the knee. The subject is supine and completely relaxed. All steps are first carried out on the uninjured leg. A, Inspection and determination of extension. B, Determination of passive flexion. This follows a comparison of active flexion with the uninjured leg, and is not carried beyond the point of pain. C, Palpation for fluid. Pressure on the suprapatellar pouch drives small quantities of fluid down and. The right index finger is shown about 1 cm. compresses the anterolateral aspect of the joint, producing fluid wave palpable by the thumbs and left hand. D, Determination of muscle atrophy. The circumference of the thighs is measured at the same level. E, Determination of cruciate ligament laxity. The knee is flexed to 90 degrees. The examiner's forearm presses firmly against the lower tibia while both hands grasp the leg just below the knee and manipulate it in the sagittal plane. F, Determination of collateral ligament laxity. One of the examiner's hands rests on the table and firmly grasps the femoral condyles. The other grasps the ankle and manipulates the extended knee in the coronal plane.

medial meniscus derangement. Occasionally in the past the medial or lateral components of the taping have been torn during a practice session or game. This has not occurred since the practice of folding the long collateral strips of tape on themselves as they cross the knee has been followed (Fig. 3D)

letic trauma, is the presence of a qualified doctor on the playing field. To leave to a trainer the decision as to whether an injured player shall continue to play or walk from the field, or be carried off is to gamble with permanent disability with the risk checked against the

# QUIGLEY KNEE INJURIES INCURRED IN COLLEGE FOOTBALL

If after examination on the practice or playing field the doctor decides that further play is inadvisable the player is taken usually in a wheeled litter, to the field house where his clothes are removed and the knee carefully and gently surveyed for gross or major injury (Fig 1) Except in obviously minor injuries anteroposterior and lateral roentgenograms are taken. No exact diagnosis or prognosis is ventured at this time. If no major fracture is disclosed by x ray examination and no obvious gross injury is present a sponge rubber compression bandage is applied (Fig 2) and the entire leg is immersed for 30 minutes in ice water. Ordinarily this is accomplished within 10 minutes of the injury and is calculated to prevent hematoma formation at the site of the injury whether it be a contusion or a combination injury. Sponge rubber known commercially as tan open-cell sponge is used and is compressed to half its thickness with elastic cotton bandage to produce a pressure of from 40 to 60 grams per square centimeter of skin. At the end of 30 minutes of chilling the wet compression bandage is replaced with a dry one. The player is fitted with crutches instructed in their use and taken either to his room or to the infirmary to remain in bed until the next morning with the leg supported on pillows above the level of the heart. The next afternoon the bandage is removed and again the knee is carefully surveyed. Any opinion given before this time is almost certain to be wrong. Twenty four hours are required for enough localization of pain and tenderness to permit diagnostic manipulation. If the compression bandage has been properly applied there will be little or no effusion. Occasionally there is slight edema of the leg distal to the bandage. Vascular complications including thrombophlebitis have not been encountered in any instance.

The injury is classified as a sprain contusion or meniscus injury and appropriate definitive treatment is instituted.

## DEFINITIVE TREATMENT

Contusions. Contusions are the least common and least serious of knee injuries. Daily definitive treatment consists of heat in the

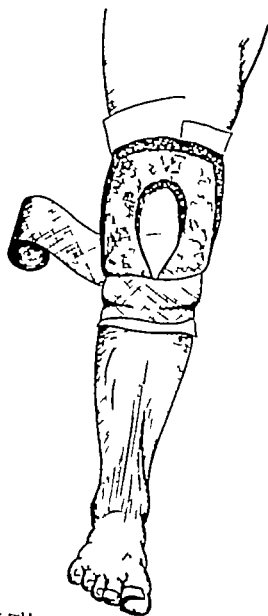


Fig. 2. Sponge rubber and elastic cotton compression bandage for immediate treatment of knee injuries.

form of whirlpool baths gentle stroking massage to stimulate lymphatic dissipation of hematoma and active exercise. Sponge rubber compression bandages are reapplied after each treatment over the anterior aspect of the joint until the possibility of effusion has passed.

When function is normal a padded fiber or plastic shield is taped over the site of the injury for a week or two lest a second blow at the same site produce a more disabling contusion. Nine contusions occurred during the season. Their severity and a related disability before the player could return to play are presented in Table I.



# QUIGLEY KNEE INJURIES INCURRED IN COLLEGE FOOTBALL

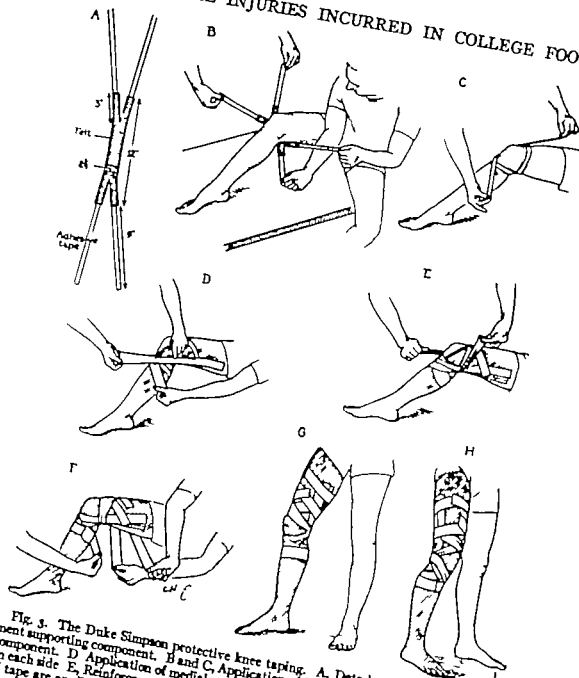


FIG. 3. The Duke Simpson protective knee taping. A, Details of the cruciate ligament supporting component. B and C, Application of the medial and lateral collateral ligament supporting components, three on each side. D, Reinforcement of cruciate ligament supporting component. Two strips of tape are applied, crossing anteriorly above and below the joint. E, Application of circular anchoring tapes. These are snug, but not constricting. F, Application of the taping. G and H, The completed taping.

has been treated for 2 or 3 weeks and vigorous quadriceps exercise has been instituted. The usual management of meniscus injuries is well illustrated by the following case

N. R., a 22 year old 210 pound varsity lineman was struck by an opposing player on the lateral aspect of the left knee and complained of pain at the site of injury. He was removed from the game and the knee carefully surveyed. No abnormality was discovered and since full speed running and "cutting" were possible without pain he was returned to play. Several days later without further injury the knee "gave way" and "something snapped" within

it. Again he was removed from the game and again examination including roentgenograms disclosed no abnormality. Cold and compression were applied and crutches were issued. Twenty four hours later, there was slight effusion in the joint and fairly marked tenderness over the lateral collateral ligament from the joint line to the fibula. A diagnosis of sprain grade 2, of the lateral collateral ligament from and definitive therapy consisting of wet heat, gentle massage and guided exercise instituted. Recovery was slow but 3 months later play was resumed with a protective strapping to the knee. On the first play after return to the line the knee was moderately twisted and locked in about 45 degrees of flexion with marked pain on its medial aspect. Once more



Fig. 4. Medial aspect of the knee joint operation (C. W.). The joint is held marked along. The medial collateral ligament has been torn from the joint and the medial meniscus from the intercondylar notch. A suture has been inserted into the end of the anterior cruciate ligament.

could add compression were applied and crutches used. Six days later the patient managed a rubbery block with thirty degrees of passive motion. Seven weeks over the anteroposterior aspect of the joint line and moderate effusion. It was now obvious that the original injury had been in all probability an example of the occasional tendency of medial meniscus injuries to manifest themselves by symptoms referable to the lateral aspect of the joint. Vigorous quadriceps exercises were instituted and 3 weeks later, a medial arthrotomy disclosed a "bucket handle" laceration extending almost the whole length of the meniscus and displaced into the intercondylar notch. The lateral meniscus as far as could be seen was normal. The entire medial meniscus was removed. Quadriceps exercises were resumed immediately after operation and a week later crutches were discarded. Ten weeks after operation protected by adhesive taping, the player participated in spring practice except for scrimmages.

Only one other meniscus injury occurred among the squads under consideration during the 1947 season and this patient was not operated upon. It is unlikely that many meniscus injuries were overlooked since a close check is kept on the activities of all athletes throughout their college careers and any disability of significance would soon appear. The 174 players in the group participated in 102 practice sessions and games during the season, resulting in approximately 17,000 exposures to injury. Since there were 2 meniscus injuries during the season a player might be said to have an expectancy of injury to one or another of his medial menisci of 1/17,000. This low incidence is attributed to prevention and early

treatment and is in contrast to the experience of Simon (9) of Louisiana who found it necessary to remove 35 menisci from 33 football players in 4 years at one university.

**Dislocations.** The rarest, but by far the most serious football injury to the knee is luxation of the tibia on the femur. Although as a rule roentgenograms should be made of any dislocation before reduction, the extreme rarity of fractures about the knee in football players and the grave danger to which the nerves and blood vessels are exposed in dislocations make immediate reduction on the field in the few moments before muscle spasm and pain occur the procedure of choice.

One such case occurred during the 1947 season, the first in over 16 years.

A 24-year-old 200-pound back was struck on the lateral and posterior aspect of the left knee by the flank of an opposing player. The foot remained fixed, the partially flexed knee was forced into extension, the femur was rotated internally approximately 90 degrees. The patella was displaced laterally. Peripheral pulses and motion of the toes and knee were normal. Within 1 minute of the injury on the field, reduction was easily effected with almost no discomfort or difficulty. Roentgenograms disclosed no evidence of fracture. A sponge rubber compression bandage was applied and a temporary plaster of paris cylinder from the toes to the groin with the ankle at 90 degrees and the knee in 30 degrees of flexion. Four days later the joint was exposed through a long curved medial incision (Fig. 4). The medial collateral ligament was found to be avulsed from its tibial insertion and lying within the joint, its distal end in the intercondylar notch. Both cruciate ligaments were ruptured near their insertions. The medial meniscus was displaced to a vertical position in the intercondylar notch. The meniscus was removed, the torn ends of the cruciate ligaments approximated and the distal end of the avulsed lateral collateral sutured in place. Fine interrupted cotton sutures were used throughout. Quadriceps exercises were begun immediately after operation and active motion on the eighth postoperative day. Crutches were discarded 2 weeks later. Three months after operation there was slight cruciate laxity, 10 degrees of lateral laxity, a normal active and passive range of motion and the circumference of the left thigh was 1 inch less than the right. The player participated in winter track and spring baseball.

Although authoritative American and European opinion in general frowns upon operative intervention (2, 5, 10, 11, 14) prolonged immobilization would have accomplished little in this

TABLE III.—INCIDENCE OF ALL KNEE INJURIES WITH REGARD TO POSITION PLAYED

Position	Backs (4)	Ends ( )	Lineemen (3)
Average number of exposures per injury	246	200	208
Average disability in days per injury	3	11.8	7.2

case with the entire medial meniscus displaced into the intercondylar notch and the avulsed medial collateral ligament lying between the tibia and femur. Examination (Fig 1) under anesthesia followed by whatever surgical exposure is indicated (8) carries little risk establishes the diagnosis with precision and may well make a great deal of difference in subsequent disability. Fortunately no injury to the popliteal artery occurred in this case. When ischemia of the leg is apparent after reduction of a dislocated knee, immediate surgery is indicated. As soon as possible the popliteal space should be explored the damaged segment of artery inspected and if necessary excised or replaced with a vein graft a lumbar sympathectomy carried out and heparinization instituted. The experience of the two world wars with regard to wounds of the popliteal artery is disheartening (3 4 6 13) and only by such vigorous measures can gangrene be averted.

*Statistical analysis with regard to position played* It is of interest to study the incidence of knee injuries in general with reference to the position of the injured player on the team. The data are presented in Table III.

# SUMMARY

1 The principles and policies of the medical department of the Harvard Athletic Association with regard to the management of knee injuries sustained in college football are presented.

2 Prevention, immediate treatment, and definitive therapy of contusions, sprains meniscus injuries, and dislocations are discussed.

3 The results of treatment of knee injuries occurring in the varsity junior varsity and freshman squads during the 1947 season are presented.

4 Two illustrative cases are presented.

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# THE EVALUATION OF SULFATHALIDINE AND STREPTOMYCIN AS ADJUNCTS IN PREPARING THE LARGE BOWEL FOR SURGERY

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THE value of antibacterial agents in preparing the bowel for surgery is recognized by the majority of surgeons and widely acclaimed by many as the greatest recent advancement in this field. A few surgeons have achieved excellent results without the use of these agents nevertheless it is our opinion that succinylsulfathiazole (sulfasuxidine) and phthalylsulfathiazole (sulfathalidine) have been influential factors in the relatively recent reduction in the mortality attendant upon surgery of the colon and rectum. The latter is exemplified by a recent series, performed by one of us (H. E. B.) of 146 consecutive bowel resections without a fatality.

Regardless of the merit of these drugs even the skeptic must admit that it would be ideal to have the bowel lumen aseptic at the time surgery is performed. Realizing that more potent antibacterial agents should be advantageous in further reducing the bacterial flora of the colon our interest was aroused by reports of various workers relative to the effect of oral streptomycin in experimental animals (3, 5, 11, 12). Since this substance was found to be effective against gram negative bacilli (4, 5, 10) was absorbed very poorly from the intestinal tract (12, 13) and, therefore relatively nontoxic systemically the thought immediately arose that here might be another useful adjunct in preparing the large bowel for surgery. It seemed likely that a combination of streptomycin and sulfathalidine might be even more efficacious chemoprophylactically. A clinical and bacteriological evaluation of

streptomycin as well as a combination of this substance with the sulfonamides, was therefore deemed advisable.

## TECHNICAL RESUMÉ OF THE STUDY

At the time of conception of this study no reports were found in the literature relative to the effect of oral streptomycin on the bacterial flora of the large bowel in human beings. Due to the presence of such factors as partial obstruction secondary infection and lowered resistance which are found in the presence of carcinoma of the bowel it was felt that the use of patients who were actually being prepared for operation would enhance the value of the results. This made the problem more difficult, prolonged its termination and necessarily curtailed the number of patients studied. However all of the latter had carcinoma of the colon or rectum with one exception.

An attempt was made to control some of the variable factors which might influence the bacterial flora. After admission to the hospital, patients were fed a general diet until two preliminary stool specimens were obtained. After the second preliminary stool specimen was secured the drug was administered and all subsequent stool specimens were collected and numbered labeled according to the time of passage date hour of administration and type of drug. They were stored in a refrigerator immediately to prevent further bacterial growth. Each patient was placed on the same high calorie, high protein nonresidue diet supplemented by protein carbohydrate mixtures (2800 to 3000 calories daily). A fluid intake of 2500 to 3000 cubic centimeters daily was maintained. Only one dose of laxative was given to each patient 36 hours prior to operation. Patients requiring barium or cleansing enemas were eliminated. Individual studies usually ex-

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tended over a 6 or 7 day period but varied in a few cases from 2 to 12 days

Previously a brief comparative study of the relative effects of sulfathalidine and sulfasuxidine on the fecal coliform bacterial counts was made by three of the authors. The results were not sufficiently standardized to be included in the present study. Consequently sulfathalidine 0.1 gram per kilogram of body weight was administered daily in 6 doses to the first group of patients. The second group of patients received streptomycin, 2 grams daily dissolved in 12 cubic centimeters of water and administered in 2 cubic centimeter doses every 4 hours with a small amount of water. Several patients received a combination of streptomycin (2 gm daily) and sulfathalidine (0.1 gm per kgm of body weight daily).

#### BACTERIOLOGICAL STUDIES

A complete bacteriologic procedure for evaluating intestinal antiseptics must necessarily consider all types of bacteria found in the gastrointestinal tract. The entire flora of man is extremely varied and, to name only a few of the most important groups, consists of coliforms and related organisms, enterococci, Clostridia, Bacteroides and the Shigella group of bacillary dysentery. Obviously the task of isolating and accurately identifying so many diverse species is an extremely complex one which the authors were not prepared to undertake. Instead two simpler methods were adopted namely (1) coliform count and (2) total count. In the first named procedure a series of dilution tubes are cultured on eosin methylene blue agar the coliform colonies counted, and this figure used to estimate the number of organisms in the specimen. The latter term 'total count,' denotes a method whereby an attempt is made to culture and count all of the important aerobes and anaerobes. Appropriate dilutions are added in duplicate to sets of veal infusion agar plates upon which the medium employed does not permit growth of certain bacterial genera, notably the lactobacilli.

**Neutralization of drugs** The relatively large amounts of sulfathalidine present in the specimens could be effectively neutralized by incorporating 5 milligrams per cent para amino benzoic acid in the water dilution tubes. Satisfactory inactivation of streptomycin was obtained with semicarbazide (8). The procedure was modified from that described by Rake and Donovan in that sodium acetate was employed in place of the potassium salt. From preliminary trials it was determined that effective inactivation occurred within 5 minutes and that the concentration of semicarbazide acetate carried over to culture plates was not itself inhibitory. Since high concentrations of streptomycin could be expected to be present in specimens it was necessary to determine how much could be inactivated under the test conditions. This figure was found to be 1320 micrograms per cubic centimeters which is the amount present in the first dilution tube from a 132 milligrams per gram specimen. The amount of streptomycin present in the feces of patients receiving 2 grams per day was determined by examining 80 random specimens and found to vary from 240 to 12000 micrograms (12 mgm) per gram. Thus, the method appears to provide for more than tenfold the highest concentration actually observed.

**Drug susceptibility** As the study progressed the problem of reversion became more eminent and an explanation of the basis for this phenomenon was sought as well as proof that organisms actually were developing resistance to streptomycin. Consequently at the time of isolation selected strains were subcultured and stored in the refrigerator until needed. Susceptibility to streptomycin was estimated by the method of Bondi and associates. Sulfathalidine susceptibility was determined by the conventional broth tube dilution procedure.

Thirty-one isolations from 13 patients were studied in some detail for drug susceptibility. In each instance a coliform organism from a preliminary specimen was compared with one or more strains isolated during administration of drug. These bacteriological studies are being reported in detail in a separate publication.

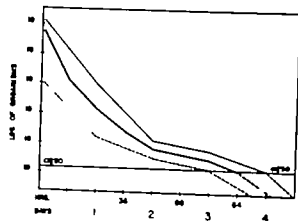


Chart 1. Coliform counts after sulfathalidine administration, grams per kilogram of body weight daily. — Highest count in any patient. - - - Lowest count in any patient. Count 6 patients.

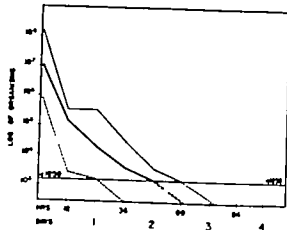


Chart 2. Coliform counts after streptomycin administration, grams daily. — Highest count in any patient. - - - Lowest count in any patient.

### RESULTS

**Sulfathalidine.** Seven patients all with a adenocarcinoma of the rectum were given sulfathalidine. The results were uniform in 6 patients and are depicted in Chart 1. The preliminary counts varied from  $10^6$  to  $10^8$  and within 3 to 4 days dropped to less than 1250 organisms per gram of wet feces. The average drop occurred in  $3\frac{1}{2}$  days. Many of the plates at this time had no growth at all but since the use of lower dilutions was not considered practical values less than 1250 organisms per gram of wet feces were not determined. When the coliform flora has been decreased from  $10^7$  to 1000 it represents a reduction of 99.99 per cent.

One patient failed to respond in the usual manner. The explanation for this failure is not obvious since medication diet etc. were properly administered and the patient was very co-operative. Yet, the count remained high for 7 days and at the end of 10 days was still 12,500 organisms per gram of wet feces.

**Streptomycin.** When this study was conceived there was some question concerning the quantity of streptomycin that should be used. After conferring with Dr. J. Carlisle 2 grams was selected as the daily dosage. This was dissolved in 12 cubic centimeters of water and administered orally in 6 doses 2 cubic centimeters every 4 hours followed by a glass of water. Twelve patients received 2 grams of streptomycin daily. One patient had a re-

current carcinoma with a rectovesical fistula following sigmoidectomy performed at another hospital. At the end of 4 days his counts remained exceedingly high. In 2 other patients somewhat bizarre results were obtained. In 1 patient a susceptible *Aerobacter aerogenes* was isolated from the preliminary specimen and at the end of 62 hours a very resistant coliform organism (unidentified) was isolated from a stool with a 9,000,000 coliform count. In the other patient a susceptible coliform organism was isolated from the preliminary stool. At the end of 33 hours the coliform count in this patient was 260,000,000 and a resistant *Escherichia coli* was isolated. Operative intervention prevented further study and it was felt that definite conclusions should not be drawn in these instances.

Chart 2 diagrammatically represents the rather spectacular results which followed the oral administration of streptomycin in the 9 remaining patients. It was interesting to note that in 2 patients the count approached less than 1250 organisms within 12 hours. The longest time required for a drop to less than 1250 was 60 hours while the average time required was 48 hours.

Results were so excellent in the majority of these patients that it appeared that some of the streptomycin might have been wasted. Consequently a daily dose of 0.5 gram was employed in 6 patients. The results were in-

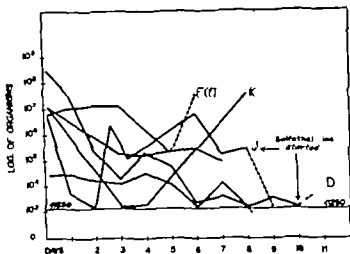


Chart 3. Coliform counts after 0.5 gram streptomycin daily. Reversion in 2 patients (K and J).

consistent (Chart 3) and in general the counts decreased slowly in this group. Reversion apparently occurred in patient K (Chart 3) and probably in patient J. In the latter patient sulfathalidine was started on the 8th day and the count was less than 1250 organisms within 24 hours. Reversion apparently occurred in patient F also. The elevation of the final count in patient D to 10 000 organisms per gram of wet feces may or may not be significant. From these observations it was obvious that 0.5 gram of streptomycin was not the optimum dosage.

**Combined administration.** Fourteen patients received combined therapy. It was necessary to eliminate 2 patients who received the correct dosage of sulfonamides but only 1 gram of streptomycin. Twelve patients received 2 grams of streptomycin and 0.1 gram of sulfathalidine per kilogram of body weight daily. A preliminary report of this work was given recently (1) and with the exception of minor changes our results and conclusions are the same at the present time. Results were exceptionally uniform during the first 3 days (similar to streptomycin above). In all patients except one the coliform counts were less than 1250 organisms per gram of wet feces within 48 hours. In the exceptional patient (patient B in Chart 5) the counts remained exceedingly high for 5 days and had these counts been included in the results which are shown in Chart 4 the average would have been completely distorted.

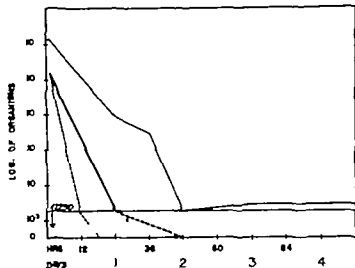


Chart 4. Coliform counts after combination of streptomycin 2 grams daily and sulfathalidine, 0.1 gram per kilogram of body weight, daily. — Highest count in any patient. --- average count in 12 patients. . . . lowest count in any patient.

In most of these patients studies were carried on for several days and reversion of the counts was encountered in 3 patients. A graphic representation of this phenomenon may be seen in Chart 5. In each instance resistant organisms were isolated after the counts had returned to levels of  $10^4$ ,  $10^5$ , and  $10^6$ .

**Total fecal bacterial counts.** The desirability of studying the entire fecal flora was recognized from the beginning of this problem. Because of the extensive work required for such studies, however, it was decided to use coliform counts for the most part. Both coliform and total counts were performed on all specimens from 6 patients receiving a combination of sulfathalidine and streptomycin.

In 5 instances the coliform count dropped promptly and no reversion was noted; the sixth patient showed a slow, gradual decrease for 5 days and reversion at 10 days. No significant change in total count was noticed in 2 instances and only a partial temporary drop in the other four. Streptomycin-resistant organisms were isolated from the late specimens of all 6 patients.

#### DISCUSSION OF RESULTS

In the beginning of this study the authors believed that evaluation of streptomycin and sulfathalidine as chemoprophylactic agents would not be too complex but as our obser-

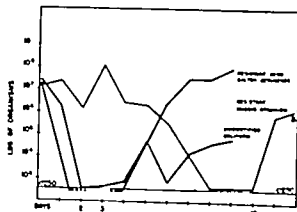


Chart 5. Reversion Coliform count following combination of sulfonamides and streptomycin, 3 of 1 patient.

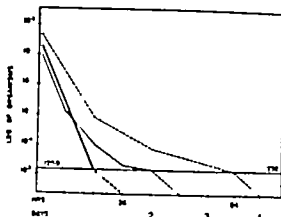


Chart 6. Average coliform count — — — Sulfathiazole 0.1 gram per kilogram of body weight daily — streptomycin 2 grams daily — combined, same dose.

vations progressed the use of several patients was precluded by complicating factors such as incorrect diet inadequate medication and improper collection of specimens. In any case where there was some doubt as to the validity of the results the patient was eliminated. In complying with these requirements the total number of patients included in evaluating the results was reduced to 33.

Although this series is not large certain conclusions of clinical and bacteriologic value may be conjectured.

The results with sulfathalidine served merely to verify the work of Poth (6). There were only 7 patients in this group but the results were very consistent in 6. The bacterial counts dropped in every patient to a satisfactory level prior to surgery, although the average time required was 3½ days. No obvious reversion occurred in this group. One may conclude that sulfathalidine is a reliable agent for decreasing the coliform flora of the large bowel prior to surgery.

From our observations, large doses of streptomycin (2 gm. daily) appear to be excellent for reducing certain strains of coliform organisms in the large bowel and other investigators (14) have found it to be effective in reducing clostridial organisms. It was obvious from the results obtained after the administration of 0.5 gram of streptomycin daily that this dosage was not adequate. The reversion that occurred in patients K and J (Chart 3) was due to the appearance of a streptomycin resistant coliform organism. The frequent occurrence of

this phenomenon would apparently preclude the use of such small doses of streptomycin.

Results in the group of patients who receive a combination of streptomycin and sulfathalidine were somewhat disappointing since it was our hope that sulfathalidine and streptomycin in combination would entirely prevent reversions due to the appearance of drug fast organisms. Such was not the case. However the combination of drugs was superior to either one alone in one important respect namely the rapidity with which the coliform count dropped (see Chart 6). If the study of these patients had been limited to 3 days the results would have been classified as excellent. Fortunately most of the studies were extended over longer periods of time and other important observations were made for example the frequency with which reversion in counts occurred. Although it is well known that drug resistant organisms often appear during treatment with streptomycin we had hoped that combined administration with sulfathalidine would prevent the occurrence of this phenomenon. Nevertheless 3 of the 12 patients had a reversion of their counts and pure cultures of streptomycin resistant organisms were isolated in each instance. One was apparently resistant to sulfathalidine but the others were not tested. In patient H contamination occurred during the operation with a resulting peritonitis, multiple intra abdominal abscesses and death. Without the aid of the antibiotics and sulfonamides therapy was hopeless. The re-

covery of streptomycin resistant organisms from the late specimens of the 6 patients in this group upon whom total counts were performed, adds further support to the theory, that prolonged administration of streptomycin is not desirable. It is unlikely that a combination of these drugs, at least in the doses used by us can significantly alter the total bacterial population for prolonged periods of time.

Analysis of the bacteriologic data suggests only one explanation for the reversion in coliform counts which were encountered, i.e. the appearance and multiplication of a drug resistant organism. On the other hand, reversion did not always accompany the appearance of a resistant coliform, provided the patient was receiving both streptomycin and sulfathalidine. The obvious explanation for such a discrepancy is that those bacteria resistant to streptomycin were, nevertheless, susceptible to the sulfonamide. Experimental evidence to support this view was obtained in several instances. Thus the development of resistant coliform organisms should occur less frequently in patients receiving a combination of the two drugs. Although our data show reversion occurring as frequently in the group receiving the combination as in the group with streptomycin alone this is possibly due to the limited number of cases involved.

The results obtained with the combination of drugs indicate that administration for 24 hours is sufficient to reduce the coliform population of the bowel by approximately 99.99 per cent. Apparently no harm is done by continuing the program for a total of 48 hours. Further prolongation, however, runs the risk of encouraging development of bacteria resistant to streptomycin and should be avoided.

Although we found that sulfathalidine required on the average  $3\frac{1}{2}$  days to produce a base line drop in coliforms, Poth's figures in a large series of cases indicate that 5 to 7 days may be necessary for consistent results. Because he has obtained such excellent healing of intestinal anastomoses with this regimen (6), we hesitate to recommend a shorter period. Since combined administration appears to have merit we feel safe in proposing the use of sulfonamides for 5 days with the addition of streptomycin 48 hours prior to surgery.

It should be emphasized that the chemoprophylactic program recommended was not subjected to bacteriological study but rather is derived from our results. In the future it may be found that larger doses of streptomycin are advantageous.

In these preliminary experiments we have limited ourselves largely to the coliform count. *Escherichia coli* is only one of the many intestinal inhabitants. Recent studies by other investigators, as well as our own limited data obtained from "total counts," indicate that fecal coliform counts do not accurately reflect trends in total population. More accurate evaluation of the chemoprophylactic effectiveness of the sulfonamides and streptomycin must await results of more detailed studies.

# SUMMARY

1. Certain properties of streptomycin indicated that it would be a valuable adjunct in preparing the large bowel for surgery. Therefore a comparative evaluation of sulfathalidine, streptomycin and combinations of the two was undertaken, patients with carcinoma of the rectum or colon being used as subjects.

2. The intestinal bacterial flora was studied by means of coliform and total bacterial counts. An explanation of reversion of these counts was sought through the study of drug susceptibilities of selected strains of organisms.

3. The average fecal coliform count decreased by 99.99 per cent in  $3\frac{1}{2}$  days with 0.1 gram per kilogram of body weight daily of sulfathalidine in 2 days with 2 grams of streptomycin and in 24 hours with a combination of the two.

4. Reversion in count due to resistant organisms was not observed with the sulfonamide, but did occur with streptomycin especially in those patients who received (0.5 gm) daily. Combined use of the two drugs did not entirely prevent this phenomenon.

5. A coliform organism which became resistant to both drugs preoperatively was responsible postoperatively for a generalized peritonitis which proved fatal.

6. On the basis of our preliminary experiments the use of streptomycin alone cannot be recommended. However a program which includes sulfathalidine for 5 to 7 days and the addition of streptomycin 48 hours prior to sur-

gery is worthy of trial. With this program the benefit of the higher antibacterial activity of streptomycin is obtained and the risk of producing resistant organisms is thus minimized.

7. Bacteriological studies indicated that the coliform count fails to reflect accurately the total colonic bacterial population including important pathogens.

8. More conclusive evaluation of the effectiveness of these drugs on the fecal bacterial flora awaits the results of similar and more detailed investigation.

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# TUMORS OF THE VERTEBRAL COLUMN

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**A**BNORMALITIES in the density, structure, or general configuration of the vertebral bodies or neural arches may be produced either by tumors arising primarily in the vertebral column or surrounding structures or as a consequence of metastasis from neoplasms located in other parts of the body. Due to the proximity of some important organs and of the central nervous system to the vertebral column the prognosis as well as the treatment of these tumors is somewhat different from that for the same type of lesions located in the extremities. In order to obtain a better clinical understanding of these neoplasms, we studied all the patients with tumors of the vertebral column seen at the State University of Iowa Hospitals with good clinical and roentgenographical follow up.

It is not our aim to discuss all the aspects of this problem or to give a complete review of the literature but to describe in detail those vertebral tumors which due to their localization evolution response to treatment or end result, warrant consideration. Although this report is mainly concerned with the primary tumors of the vertebral column, tumors affecting the spine through contiguity or metastasis were also included. Only the primary tumors of the vertebral column which could be examined microscopically and the metastatic tumors to the spine with known primary lesion were included in this study.

## HEMANGIOMA

Two patients with hemangioma of the vertebra were studied. One of these tumors was found at autopsy in the body of the eighth dorsal vertebra. It had never produced clinical symptoms.

The second patient was a 42 year old woman who sustained a fall 6 months prior to admission. Then she complained of numbness in both legs and right arm, and difficulty in walking. Neurological examination

showed the presence of compression of the spinal cord at the level of the lower cervical spine. The anteroposterior roentgenogram showed a honey-comb appearing lesion involving the body and neural arches of the seventh cervical vertebra. The lateral roentgenogram showed a marked increase in size of the vertebral body bulging of the walls, and new bone formation (Figs 1a and 1b).

The patient was treated by means of roentgen therapy with temporary improvement of the symptoms. However the patient's condition became suddenly worse, and an almost complete paralysis on the right side of the body developed. A laminectomy was immediately performed and on removal of the lamina of the seventh cervical vertebra, the bone was found to be very vascular. No extradural soft tissue tumor was encountered. Microscopical studies confirmed the diagnosis of hemangioma. The patient recovered very quickly following the operation, and when last seen in this hospital, 13 months after operation the only residual symptom was a slight weakness of the right arm. The roentgenogram at that time showed the lesion to be unchanged.

While vertebral hemangiomas are frequently found at autopsy (10.7% in Schmorl statistics 11.93% in Topper statistics) the diagnosis is rarely made clinically. This may be due either to the lack of symptoms given by the vertebral hemangiomas or to the difficulty of its roentgenographic visualization. Connell and Hay, and Hammes have reported proved cases of hemangioma involving the neural arches in which repeated x ray examinations were completely negative.

The usual site of the vertebral hemangioma is in the dorsal and lumbar regions (Blackford, Kelly, Perman, Livingston, Ireland). Hemangioma of the cervical vertebrae is an extremely rare entity. Bucy and Capp in 1930 stated that there were no cases involving the cervical vertebrae. Heaney and Whitaker reported in 1933 the first case involving the axis but their diagnosis was based on the roentgenogram only and no histological examination was obtained. The first histologically proved case of hemangioma involving the cervical spine and producing compression of the spinal cord was reported by Geschickter and Keasbey. It involved the bodies of the fourth, fifth and sixth cervical vertebrae.

From the Department of Orthopedic Surgery, State University of Iowa, Iowa City.



Schlesinger and Ungar in 1939 described another histologically proved case, involving the seventh cervical and causing compression myelopathy. In 1941 Ghormley and Adson reported 39 cases of vertebral hemangioma of which only 1 was of cervical localization.

Holts in 1942 reported a new proved case involving the body of the fourth cervical that had produced a pathological fracture.

Due to the fact that many of the present day foreign periodicals are not available, a complete review of the literature was impossible. However investigation of most of the American and foreign publications since 1930 has failed to reveal any additional cases. Consequently our patient may be considered the sixth case of cervical hemangioma producing clinical symptoms to be reported in the literature and the fourth one of such localization proved by microscopical studies.

Regarding the treatment of this condition most authors agree that the best results can be obtained by means of roentgen therapy. Surgical intervention is advisable when there are persistent signs of cord compression but other wise is contraindicated because of the high mortality produced by the postoperative bleeding (1 of 5 patients operated upon according to Ferber and Lampe 21 1% mortality according to Schlesinger and Ungar).

The increase of the neurological signs following roentgen therapy in our patient justified surgical intervention.

#### GIGANT CELL TUMOR

Since 1924 when Lewis reviewed 16 cases previously reported in the literature and added a new one, several authors have described this condition (Santos and Jenkinson and Hunter McFarlane and Linell Willard and Nicholson) making a total of 91 cases reported up to 1945 (Brock and Bogart).

In the files of this hospital 2 cases of giant cell tumor involving the spine were found. Both were in patients of the same age and the lesions were localized in the second and third sacral segments. Although according to Richards and Singleton giant cell tumors of the spine may be of the osteolytic or of the osteoblastic variety both our patients had a purely osteolytic lesion involving one sacral segment.

Both lesions appeared in patients belonging to the same age group and in the same location however the end results were completely different.

A 13 year old male was seen here 4 months following direct trauma over the sacrum. He complained of localized sacral pain present only when sitting. His general condition remained excellent throughout. On local physical examination a tender spot 3 inches below the posterosuperior iliac spine was found. On rectal examination a tumor situated in front of the sacrum was palpable. Roentgenographic studies demonstrated the presence of an osteolytic lesion that had entirely destroyed the third sacral segment (Fig 2a). No peristosteal reaction was present. A biopsy was performed and during operation the destruction was found to have been so complete that a finger could be introduced through both walls of the sacrum. The frozen sections demonstrated a giant cell tumor and it was decided to suture without any further surgery.

The patient received 800 roentgens postoperatively. Serial roentgenograms taken every few months demonstrated disappearance of the osteolytic area and reconstruction of the second sacral segment (Fig 2b). There was no metastasis.

The patient was periodically checked for at least 3 years. Six years after biopsy, the patient was in excellent general condition and in active military duty.

The other patient, a 13 year old female had spontaneous onset of paresthesias in both legs without previous trauma. One week later bladder disturbances and weakness of the lowers were present. On admission (3 weeks after the onset of symptoms) her gait was unsteady and her legs very weak. Physical examination demonstrated the existence of anesthesia over the second, third, and fourth sacral dermatomes, loss of rectal tone and absent deep reflexes in the lowers. Spinal fluid and blood chemistry studies were negative. Complete destruction of the second sacral segment was observed in the roentgenograms.

A very vascular tumor growing around the sacral roots and completely destroying the second sacral segment was found at the operation. Due to the infiltrative character of the process, only a partial removal of the mass was possible. Following surgery 300 roentgens were given.

The patient progressively improved and a few weeks afterward she was able to walk, the rectal and bladder control being again normal.

Two months after operation, patient developed a sudden catch in the left side of her back. Most of the previous signs recurred, this time being more marked on the left lower extremity. Physical examination showed the presence of a fluctuant swelling about the size of an apple over the sacral region. Aspiration biopsy confirmed the recurrence of the giant cell tumor but no histological signs of malignancy were found. The roentgenograms showed

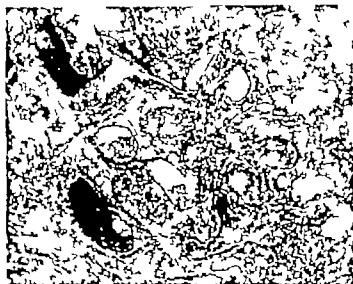


Fig 1 a and b, Hemangioma involving the seventh cervical vertebra c, Microscopic aspect, low power

advanced destruction of the sacrum and a pathological fracture through the wing of the sacrum was already present. Further roentgen therapy was administered. The patient died 16 months after the initial surgical intervention.

The end results obtained in these two giant cell tumors which were devoid of pathological signs of malignancy were striking. Although both patients were operated upon in the first one only a biopsy was performed. In the second case a partial removal was necessary due to presence of neurological signs of compression. Some authors state that biopsy (Brailsford Kolodny and Pfahler and Parry), curettage partial or total removal (Bower Clark and Davis) may stimulate further activity or facilitate the apparition of recurrences especially when they are combined with irradiation (Coley and Higinbotham). As in our second case patient was treated by means of partial removal plus x ray therapy it is possible that the treatment influenced the evolution of the tumor but it will be unfair to forget that the partial surgical removal was not an elective measure but determined by the intrinsic infiltrating characteristics of the tumor—characteristics that were not present in the first case.

On establishing the indications for the treatment of giant cell tumors of the spine we must



take into consideration their location. When they involve only the neural arches successful cures after complete removal have been reported (Vegh Milch). If the involvement of the vertebral body is only partial and in an area close to the pedicles, successful results can also be obtained by removal of the involved arches and curettage of the vertebral body (Duncan and Ferguson). When the tumor occupies most of a vertebral body the treatment of choice is roentgen therapy. Several cases have been described in the literature in which a complete reossification of the vertebral body took place following treatment as

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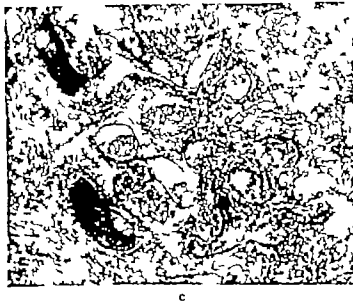


Fig 1 a and b, Hemangioma involving the seventh cervical vertebra c, Microscopic aspect, low power

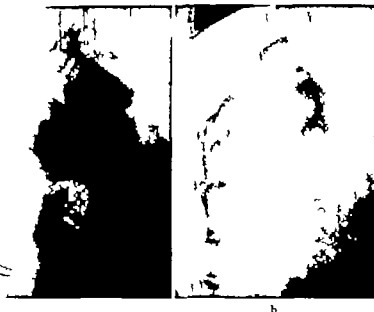
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b

Fig. a, Destruction of the body of the third sacral segment 4 months after onset. b, Reconstruction of the third sacral segment following ray therapy. c, Microscopic aspect, high power.



sacrococcygeal region. However they may appear at any level of the spine and undergo malignant degeneration giving origin to tumoral neoformations.

The clinical signs of these tumors depend to a great extent on their location. The roentgenograms usually show an area of rarefaction without signs of new bone formation. In the advanced stages, a soft tissue shadow can also be observed.

The microscopical structure of the chondromas is by no means uniform. Regional variations can be observed even in the same tumor. Among our material there was a specimen (for which a clinical record was not available but that was included in this report because it allowed an excellent histological understanding of this condition) in which some regions appeared formed by solid rods of cells having an epithelial appearance (Fig 3b). In other regions the tumoral cells had a clearer protoplasm or presented a marked distended protoplasm full of mucinous material (physaliphorous cells of Virchow).

The process of vacuolation and mucin formation is more pronounced in other cases in

happened in our first case (Brock and Bogart, Brunswick Cotton).

Spontaneous cures may occur as described in a case reported by Murphy following pathological fracture.

#### CHORDOMA

According to Ehrenhaft notochordal tissue remnants are found during postmortem examinations in 2 per cent of the cases. They usually appear in those areas in which only a moderate amount of cartilaginous tissue surrounds the chorda, i.e., the base of the skull and

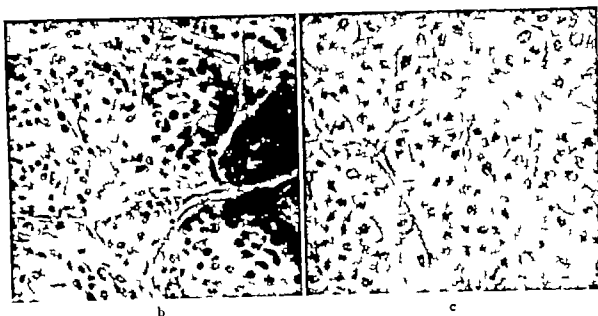


Fig 3 a Chordoma destroying the sacrum. Photograph obtained from a microscopic slide, enlarged 2 times. b, Microscopic aspect through the upper part of the tumor. High power. c, Microscopic aspect through the lower part of the tumor. High power.

which the cells adopt a syncytium like appearance. A great amount of mucin is present in the intercellular spaces (Fig 4b). Areas of necrosis are not infrequent.

These different histological aspects have been explained by Alezais and Peyron on basis of the different stages of evolution of the notochord. Steward described the presence of nuclear vacuolation and stated that it was more frequent in the cellular parts of the tumor being apparently absent in the areas with abundant mucin. Steward and Morin reported the existence in these tumors of spherical bodies formed by concentrically arranged groups of cells that they compared to 'nests of beakers'. Although the presence of such formations has been confirmed by Cappell we were unable to find them in our histological sections.

It is at present widely accepted that the best treatment of these tumors is their total resection (Mixer and Mixer, Mabrey) because as a rule they are radioresistant. The evolution of the case corroborates this point of view.

A 54 year old male suffered a direct trauma over the sacrum 2 years before admission. This was followed by persistent pain which became progressively worse until he was unable to work and sleep.



Fig 3a.

A few months later he developed some rectal trouble and a so called rectal abscess was incised. The patient was relieved for 3 months following which the sharp stabbing pain reappeared. Two weeks before admission the patient complained of radiating pain along the outer aspect of the leg and foot, with a sensation of numbness in the outer aspect of the thigh.



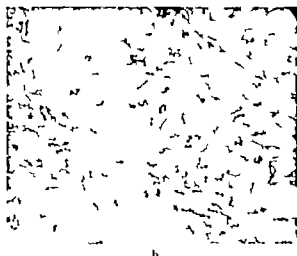
Fig. 4a.

The local physical examination showed marked spasm of the sacrospinalis muscle and a swollen and acutely tender area covered by edematous skin extending from the fourth lumbar vertebra down the entire left buttock. Rectal examination showed the presence of some tenderness over the sacrum and coccyx. The roentgenograms showed the distal portion of the sacrum to be markedly destroyed by an osteolytic process that involved both sacral wall (Fig. 4a).

The diagnosis of chondroma was made first by an aspiration biopsy. The surgical biopsy confirmed the diagnosis. Histological studies showed the presence of basophilic cells with large nuclei and finely vacuo-



Fig. 5. Microscopic aspect of chondroma arising from the body of the sixth dorsal vertebra.



b.

Fig. 4. a, Chondroma destroying the sacrum. b, Microscopic aspect, lower power.

lated protoplasm. The borders of the cells were indistinct and some of them appeared very distended. Many signet-ring forms were present. No mitosis was observed but there was considerable nuclear pleomorphism.

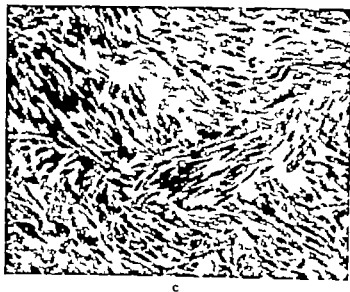
The tumor was considered to be too widespread to be surgically removed. Roentgen irradiation treatments were given. In spite of this treatment, the tumor continued to increase in size. Although the patient had temporary relief of his pain following each treatment, neurological signs of cauda equina



Fig. 6. Calcified chondroma arising from the posterior surface of the sacrum. Sacral contours outlined in white.



Fig 7. a and b, Fibrosarcoma involving the neural arches of several lumbar vertebrae. The upper portion of the tumor is calcified. c, Microscopic aspect of the tumor high power



compression and root involvement appeared. Locally, a hard mass of osseous consistency could be palpated in the buttock.

In order to relieve the pain it was necessary to perform a chordotomy. No metastasis could be observed after several roentgenographic examinations. The patient died 2 years after first admission.

#### CHONDROMA

Benign cartilaginous tumors arising from the neural arches have been frequently reported (Paulian and Bistriceano, Rix and Geschickter). Chondromas arising from the vertebral body itself are considered less frequent. The patient studied by us is of particular interest. The evolution of his cartilaginous tumor seemed to corroborate the statement made by Geschickter that the prognosis of chondromas is not dependent upon the histological picture but upon their localization.

A 45 year old female on admission complained of sharp pains of 9 months duration over her right chest, associated with the respiratory movements. The intensity of the pain had been progressively increasing.

On admission the physical examination was inconclusive. Roentgenograms of the dorsal spine, taken following induced pneumothorax, showed the

presence of a mass at the lateral side of the body of the sixth dorsal vertebra. A few days later a laminectomy was performed and a tumor the size of an egg arising from the body of the vertebra and projecting inside the pleural cavity was found. Anatomopathological studies showed the presence of a chondroma (Fig 5).

Following resection she was very well for about 1 year when the same type of symptoms but with greater intensity reappeared. Repeated roentgenograms showed the recurrence of the growth at the same level. At operation a mass the size of a golf ball was found in the same previous localization. A very careful complete removal of the tumor was performed and microscopical studies showed a typical chondroma without signs of malignancy. After operation, roentgen therapy was instituted.





Fig. 8. Microscopic aspect of chondrosarcoma involving the eighth dorsal vertebra.

Following the operation she was completely free from pain for only a short while. A few weeks later she started to complain of pain over the abdomen. The gall bladder and the appendix were removed without the slightest relief. A body brace was then given.

She returned after 4 years complaining of weakness and numbness of the legs, inability to walk, and numbness in the abdominal wall. Physical examination showed a paraplegia with hyperactive deep reflexes and sensory loss from the level of the fourth dorsal dermatome down to the toes. A recurrence of the tumor was detected on the roentgenograms,



Fig. 9. a, Multiple myeloma involving the dorsal spine.

with destruction and mild compression of the same vertebral body. New surgical intervention was performed and a huge chondroma compressing the cord was found. The tumor completely invaded the vertebra and the ribs. Only a sufficient amount to make the spinal canal as large as normal was removed. The aspect of the tumor was unchanged. In macroscopical examination no signs of malignancy could be found.

Following operation the pain did not diminish and it was necessary, later on, to perform a chordotomy. The patient died 6½ years after first admission.

When these tumors are localized at the neural arches and grow posteriorly they may reach enormous sizes without producing serious complications as demonstrated by the case reported by Ljachovitzky in the cervical spine and by one of our cases arising from the sacrum and producing an enormous growth during an interval of several years.

A 61 year old male gave a history of fall on left hip 10 years prior to admission. Six years following the fall the patient noticed a lump over the left side of the sacral region. It was neither painful or tender but the patient noticed some back pain after a heavy day's work. The mass grew very slowly until 3 years before admission, at which time it began to grow more rapidly. Six months before admission there was some tenderness on palpation, the mass became swollen and began to produce a steady aching type of pain with short intervals of radiation down to the left leg. There was no loss of weight or appetite and the general condition of the patient remained excellent throughout.

On physical examination a hard, nodular growth measuring 15 by 10 by 7 centimeters fixed to the sacrum was found. It was slightly tender on palpation. On the roentgenograms the tumor appeared to invade the sacrum and project backward (Fig. 6).

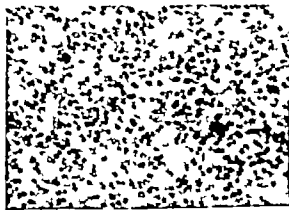


Fig. 9. b, Microscopic aspect of the tumor (high power).

Surgical removal was undertaken. During the operation it was observed that the mass was lobulated and presented areas of softening. It was chiselled away from the sacrum but a complete removal was impossible because the sacrum was deeply involved.

The histological slides showed a tumor composed mainly of cartilaginous cells. The matrix was hyaline and very abundant, much of which was calcified. In some places there was myxomatous degeneration. No evidence of malignancy was observed.

At present, 7½ years after surgical removal the patient is in excellent general condition, works on his farm and has only occasional mild back pain.

The treatment of these tumors is total resection if possible. They usually do not respond to roentgen therapy. Good results after total removal have been reported by several authors particularly in tumors located in the neural arches (Peycelon and Aufrere, Ljachovitzky) provided no neurological complications are present and that removal is complete.

#### FIBROSARCOMA

Seven cases of fibrosarcoma were studied. The process was localized in the lumbar spine in 3 cases in the dorsocervical region in 1 instance. In the remaining cases the process had produced a destruction of the sacrum.



Fig 10 Localized destruction (arrows) of two lumbar bodies produced by metastasis from carcinoma of the breast.

The age of the patients ranged from 3 to 73 years. Six were males. A history of definite local trauma before the onset of symptoms was found in 3 cases. The first symptom was in accordance with their localization. The

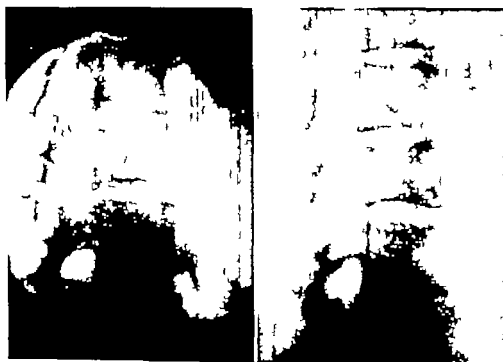


Fig 11. a left, Osteolytic destruction of the posterior part of the second lumbar vertebra before treatment. b After x ray therapy and testosterone, some recalcification can be seen. Some osteoplastic nodules can be seen in upper and anteroinferior part of the second lumbar vertebral body.



Fig. 1a

cases involving the sacrum usually presented sciatic pain; those involving the lumbar spine usually developed low back pain; and in the 1 case involving the cervicodorsal region weakness of one hand was the initial symptom.

Fullness or presence of a mass in the paravertebral region or on rectal examination was



Fig. 3a



Fig. 2b

Fig. 2. a, Collapse of lumbar vertebral body produced by metastatic hypernephroma. b, Microscopic aspect of the tumor.

present in 4 cases. Tenderness over the spine on palpation or percussion was found in 3 cases.

In the roentgenograms the lesion was seen to be purely osteolytic. It was confined to the vertebral bodies in 2 cases; to the neural arches in 1 case; to the whole vertebra in 1 case; and the sacrum and sacroiliac joint in the 3 remaining cases.

The clinical diagnosis was confirmed by aspiration biopsy in 2 cases; in the remaining ones by surgical biopsy or at autopsy.

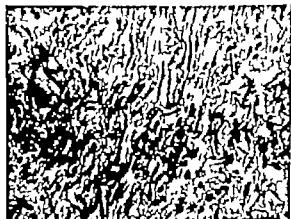


Fig. 3b

Fig. 3. a, Perineural fibroma involving the bodies and neural arches of the 11th dorsal and first 12 lumbar vertebrae. b, Microscopic aspect of the tumor. High power.

The end result in 6 cases is known to us. Two died shortly after admission. In the third case diagnosis was incorrect and two drainage operations were performed. Later on he was treated with x ray radiation and died 14 months after the onset of symptoms. The fourth case was treated only by means of x ray therapy after the clinical diagnosis had been confirmed by aspiration biopsy. The patient died 27 months after the onset of symptoms. The fifth case presented clinical signs of cord compression and it was necessary to perform a laminectomy. The patient died a few months after operation. Finally the sixth case has been followed for over 5 years and has had no recurrences. Although some authors have reported 5 year cures in cases of fibrosarcoma involving the spine (Aviragnet and Duhem) their number is relatively small. A detailed report of our case seems justified.

This patient was a 57 year old male who 3 years prior to admission to the hospital started to have some pain localized in the middle of his back. One year later a lump the size of a silver dollar was noticed. The pain became more acute and the tumor increased in size. On admission local physical examination showed the existence of a swelling twice the size of a fist, just lateral to the spinous processes on the right side and extending from the tenth dorsal vertebra to the third lumbar. This mass was tender and fluctuant on palpation. Roentgenographic studies revealed the destruction of the pedicle of the first lumbar vertebra on the right side, the presence of a soft tissue mass extending down into the lower lumbar region and the existence of an area of calcification in the upper pole of the tumor (Fig 7a and b).

An aspiration was performed and myxoid material obtained. Microscopic studies confirmed the diagnosis of fibrosarcoma.

A few days later surgical removal of the tumor was undertaken. The mass was moderately well encapsulated lying in the angle formed between the spinous and the transverse processes, of the lower dorsal and upper lumbar regions. The tumor was adherent to the transverse processes of the lumbar vertebrae making it necessary to strip the perosteum of some of them in order to remove the tumor. Before suture, 8 radium needles and 3 milligrams of radium were placed in the walls. After operation patient received x ray therapy. At present 7 1/2 years after surgical removal he is in good general condition and there has been no local recurrence.

#### CHONDROSARCOMA

In the case we studied the chondrosarcoma was localized in the dorsal spine.

This 65 year old male had a history of onset of sharp pain in his right upper abdominal quadrant 7 months before admission. At first this pain appeared in attacks occurring about once a week but progressively becoming more frequent. He lost 10 pounds. On physical examination gastrointestinal and genitourinary series were negative except for a nonfunctioning gall bladder.

One year later he started to complain of dull aches in the legs, soreness of the spine, poor bowel and bladder control and weakness of the legs. Physical examination on readmission to the hospital showed the presence of a spinal cord compression at the level of the eighth dorsal vertebra. Roentgenographic studies demonstrated the destruction of the vertebral body of the eighth dorsal vertebra.

A laminectomy was performed and a tumor compressing the cord was found and partially removed. It had invaded the eighth rib and the right part of the vertebral body. Microscopic studies showed the presence of a chondrosarcoma (Fig 8).

Following the laminectomy the patient received roentgen therapy with marked symptomatic relief of pain. However he died 14 months later.

#### OSTEOGENIC SARCOMA

The only patient with osteogenic sarcoma of the spine seen in this hospital was a 23 year old male admitted complaining of severe attacks of pain in the back of his neck. The pain was episodic at first but later became constant and radiated to the right arm. Physical examination showed all the clinical signs of cord compression at the level of the sixth cervical vertebra. Roentgenographic studies were negative. Exploratory laminectomy was performed and a tumor involving the fourth, fifth and sixth cervical vertebrae was found and only partially removed because much bleeding was encountered. The patient died shortly after the operation. At autopsy, it was observed that the tumor had completely invaded the lower cervical region.

Although microscopic slides are at present unavailable, the diagnosis of osteogenic sarcoma was definitely established at the time of the patient's death.

#### HODGKIN'S DISEASE

Four cases of proved Hodgkin's disease presented vertebral destruction. The process was localized either in the lower cervical or in the upper dorsal segment with the exception of one case in which there was a generalized vertebral involvement. The clinical manifesta-



Fig. 2a.

cases involving the sacrum usually presented sciatic pain; those involving the lumbar spine usually developed low back pain; and in the 1 case involving the cervicodorsal region weakness of one hand was the initial symptom.

Fullness or presence of a mass in the para vertebral region or on rectal examination was



Fig. 3a.



Fig. 1b.

Fig. 2. a, Collapse of lumbar vertebral body produced by metastatic hypernephroma. b, Microscopic aspect of the tumor.

present in 4 cases. Tenderness over the spine on palpation or percussion was found in 3 cases.

In the roentgenograms the lesion was seen to be purely osteolytic. It was confined to the vertebral bodies in 2 cases; to the neural arches in 1 case; to the whole vertebra in 1 case; and the sacrum and sacroiliac joint in the 3 remaining cases.

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Fig. 3b.

Fig. 3. a, Perineural fibrosis involving the bodies and neural arches of the twelve dorsal and first two lumbar vertebrae. b, Microscopic aspect of the tumor. High power.

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tions of these vertebral involvements were represented by radicular or local pain or by signs of cord compression. One case developed a complete block at the level of the second lumbar vertebra, requiring a decompressive laminectomy.

The roentgenograms demonstrated that the process usually involved the vertebral bodies and the transverse processes. The lesions were always osteolytic in character. The intervertebral disc appeared thinned in one of the cases.

All our cases were treated by means of x ray therapy. One patient had symptomatic relief for a period of 5 years. Roentgenographic follow up during this period of time showed complete arrest of the osteolytic process.

Autopsy findings were available in 2 cases. The spongy bone of the involved vertebrae was found to be replaced by a soft tumor. This tumor was spreading over the anterior surface of the vertebrae in one case and the spinal cord in the other. In not a single instance was spinal cord compression present. At some points, several tumoral nodules localized in the posterior mediastinum appeared to be invading the vertebral bodies.

#### MULTIPLE MYELOMA

Ten proved cases of multiple myeloma involving the spine were studied. Autopsy findings of 7 were available.

The age of the patients at the onset of symptoms was between 40 to 78. Eight of the patients were males. While under the care of this hospital, 9 of them died. The interval between the onset of symptoms and death ranged from 4 months to 6 years. From a clinical standpoint, there seemed to be some acute forms of the process capable of producing death in a short time.

Repeated investigations for Bence Jones proteins were performed in 4 cases and a positive finding was obtained in only 1 instance. Among the remaining cases in which these proteins were not investigated, we found that urinary albumin was present in 4 cases.

The main clinical signs were a sensation of marked fatigue and extreme lassitude that eventually confined the patient to bed. Radic

ular pains along the distribution of peripheral nerves and pain on pressure over ribs, pelvis, and skull were frequent manifestations. Blood studies usually showed the presence of marked anemia sometimes accompanied by leucocytosis.

Roentgenographic findings varied from the apparition of a marked osteoporosis without definite destructive areas to the presence of multiple and well circumscribed osteolytic lesions.

On microscopical examination it was found that the normal elements of the osseous marrow were replaced by plasma cells or by small cells with hyperchromatic nuclei and scanty pale protoplasm which resembled plasma cells.

At autopsy multiple scattered grayish yellow or hemorrhagic nodules were found in the spine or surrounding tissues. Tumoral tissue was present in the ribs, in the vertebral bodies or in the neural arches. In some cases the tumoral neoformation invaded the neural canal or the erector spinae masses. In 1 case the cauda equina was compressed.

#### SOLITARY MYELOMA

Instances of solitary myeloma producing destruction of a vertebral body have been reported by Wright, Peyton, Paul and Pohle, Pasternack and Waugh.

Among our studied 10 cases of multiple myeloma we found 2 cases in which the lesion could be considered circumscribed to the spine during the early stages of the disease. In 1 case the tumor produced compression myelitis and a laminectomy was performed (Fig 9). This patient died of secondary infection following operation and consequently we disregard the fact that the condition would have become generalized. In the second case the lesion was confined to one vertebral body during the early stages. As the patient's general condition was excellent and improved following the use of a body brace the condition was diagnosed as Kummell's disease. However roentgenograms taken a few months later revealed the presence of a marked loss of calcium and mottling of the thoracic cage. At autopsy two vertebrae and one rib were removed. A multiple myeloma was responsible for their destruction.

In some of the cases of vertebral solitary myeloma reported in the literature, the lesions remained confined to the spine for periods of 10 years (Cutler Buschke and Cantril). In other instances however, the solitary vertebral localization was a temporary feature with multiple areas of destruction appearing several years later (Jacox and Kahn).

# VERTEBRAL DESTRUCTIONS PRODUCED BY METASTASIS FROM PRIMARY TUMORS ELSEWHERE IN THE BODY

Fifty cases with vertebral metastatic lesions were found. In order of frequency they were as follows

Carcinoma of the breast  
Carcinoma of the prostate  
Hypernephroma  
Ewing's tumor  
Chondrosarcoma  
Bronchogenic carcinoma  
Carcinoma of the skin  
Carcinoma of the rectum  
Carcinoma of the cervix  
Fibrosarcoma of the cervix  
Osteogenic sarcoma

## Cases

32  
7  
3  
1  
1  
1  
1  
1  
1  
1  
1  
50

*Carcinoma of the breast* The 32 studied cases included patients between 33 to 67 years of age. The majority of the lesions appeared in patients in the fourth (36.6%) and fifth decades (30%) of life.

The interval between surgical removal of the breast and the discovery of the spinal lesion varied from 4 months to 11 years.

The spinal segments involved in order of frequency were as follows: lumbar, dorsal, cervical and sacrum.

The most frequent clinical sign was pain either localized in the spine or radiating along the distribution of the peripheral nerve roots. Loss of weight, pathological fractures, sleep interference etc. were frequent findings.

The roentgenograms showed purely osteolytic lesions. In one case however, there were areas of osteolysis and areas of increased bony density (Fig. 11).

The neoplasm usually determined marked destruction of the involved vertebrae and the body collapsed in many instances. The shape of the vertebrae after their collapse varied

being wedge-shaped in the upper dorsal spine, while in the lumbar segment it was more frequent to observe accordion like or fish tail deformations.

In some cases the roentgenograms showed only small areas of the vertebrae destroyed by the tumor. These localized destructions were visible on the roentgenogram probably because of the fact that they eroded the cortical bone whereas the vertebral body itself preserved its normal configuration (Fig. 10).

In the treatment of these metastatic lesions roentgen therapy was used for the relief of pain. Evaluation of the results could be made in 16 cases and was as follows: complete temporary relief of pain in 5 cases, partial temporary relief in 8 cases, no relief in the remaining 3 cases.

Testosterone has been used as a palliative treatment by several authors with beneficial (Adair and Herrmann and Fels) and harmful (Farrow and Woodward Farrow) results. Testosterone was administered to 5 of our patients the first trial being performed on a patient in whom roentgen therapy had failed to produce the slightest relief of her constant pain. Despite the fact that roentgenographic ally the lesions remained unchanged, we were able to discontinue completely the administration of morphine. This patient was under hospital observation for 1½ months and received a daily dosage of 25 milligrams of testosterone. She died 2 months after returning home.

Among the remaining 4 patients the administration of testosterone was not beneficial in 3. In the fourth patient, testosterone produced complete relief of pain for 7 months. Later on the pain recurred and failed to respond either to testosterone or to roentgen therapy. The roentgenograms revealed increased density of some of the previous osteolytic areas (Fig. 11 a and b). This could be interpreted as a reossification produced by the administration of testosterone. However we should bear in mind that this patient had had previous roentgen therapy, and that reossification and sclerosis of a vertebral body following irradiation has been observed by several authors (Rix and Geschickter, Leddy, Pfahler).

*Carcinoma of the prostate.* Our patients with metastatic lesions from carcinoma of the prostate were between 44 and 71 years of age. The bone metastases were localized in the lumbar spine in 2 patients. In the dorsal segment in 3 patients. There was a generalized involvement of the spine and pelvis in the 3 remaining patients. The roentgenograms showed that the metastatic lesions were osteoplastic in all of them.

An evaluation of the results of roentgen therapy could be made in only 4 patients. One patient was completely relieved of pain. 2 patients had partial relief. 1 patient had no relief of pain. This last patient was later treated with stilbesterol and 16 months after onset of this treatment the patient feels excellent and has gained weight.

In none of our studied cases were the values of acid phosphatase (Gutman, Sproul and Gutman, Huggins and Hodges, Gutman and Gutman) recorded.

*Hypernephroma.* Three patients with hypernephroma developed metastasis in the spinal column. The metastatic lesions from hypernephroma were localized in the dorsal spinal segment in one case and in the lumbar spine in the 2 others. A pathological fracture was the first clinical sign in 1 patient. The patients were all over 50 years of age.

In the roentgenograms the lesions were seen to be purely osteolytic. The clinical diagnosis was confirmed at autopsy in 2 cases and following laminectomy in the 1 remaining. In the last case the tumor had produced a complete block at the level of the first lumbar segment and a complete destruction of the vertebral body (Fig. 12 a and b).

*Ewing's tumor.* A boy 16 years old with Ewing's tumor of the right femur developed generalized metastasis involving the other femur, the skull and the sacrum. The diagnosis was confirmed by biopsy of a nodule under the scalp. The sacral lesions were purely osteolytic.

*Chondrosarcoma.* Our case of metastatic lesion produced by chondrosarcoma is interesting because it appeared in a patient suffering from multiple cartilaginous exostosis. It was not until the patient was 48 years old that several exostoses attached to the femur under

went malignant degeneration. The patient was treated by means of roentgen therapy for 5 years with only symptomatic relief. At the end of this period, he suddenly developed signs of cord compression and died following a laminectomy. During the operation it was observed that the cord was compressed by a mass arising from the eighth dorsal vertebra. This mass could have been a primary exostosis that had also undergone malignant degeneration, but because of the patient's clinical history it was classified as a metastatic lesion.

*Bronchogenic carcinoma.* A case of bronchogenic carcinoma was studied with a partial destruction and collapse of the body of the fourth lumbar vertebra due to a metastatic lesion. The patient was a 39 year old male with a history of low back pain for 5 months, cough and difficulty in swallowing solid food for 3 months. The roentgenograms showed, in addition to the vertebral destruction, a marked mediastinal enlargement. The patient was subjected to roentgen therapy and died 3 months afterward.

*Carcinoma of the skin.* Vertebral destruction secondary to carcinoma of the skin appeared in a male 62 years old who 6 years prior to admission had developed a well differentiated epidermoid carcinoma over the right temple. X ray therapy was administered and the skin lesion healed. Four years later he noticed a small lump 1 centimeter in diameter in front of his right ear. Eleven months before admission he suddenly developed pain in the upper dorsal spine. Roentgenograms taken on admission showed a compression of the sixth dorsal vertebral body. X ray therapy was again administered without relief of pain. The patient died 1 year later.

*Carcinoma and fibrosarcoma of the cervix.* Both types of tumors produced osteolytic lesions in the vertebral bodies accompanied by pathological fracture very similar to the lesions seen in cases of carcinoma of the breast metastasizing to the spine.

*Osteogenic sarcoma.* Sarcomatous lesions associated with elevated temperature and increased white count may sometimes be confused with inflammatory conditions. The differential diagnosis in our case was based on the clinical history.

A 34 year old male was admitted in 1936 complaining of marked pain in the right hip. The patient stated that in 1922 a lump had appeared over the second metacarpophalangeal joint of his right hand. Between 1922 and 1930 this tumor was removed 5 times because of repeated recurrences. Finally in 1930, the finger was amputated. However there was a local recurrence of the tumor and in 1931 the right forearm was amputated 3 inches below the elbow. In 1934 the axillary glands became enlarged and were removed. Microscopical studies throughout confirmed the presence of osteogenic sarcoma.

The patient was asymptomatic until September 1936 at which time he developed sharp pain in his right hip. The roentgenograms at this time showed marked destruction of the hip joint. A hip spica was applied to control the pain. In February 1937, the patient developed sudden severe pain between the shoulders. A few days later there was sudden loss of bowel and bladder control, numbness from the nipple line down and severe pain on coughing and sneezing. The following day flaccid paralysis with complete motor and sensory loss was present. Roentgenograms demonstrated a paravertebral soft tissue shadow. The patient was running a temperature of 102-103 degrees and his blood count was 68,000.

An attempt to aspirate the paravertebral mass proved unsuccessful. A laminectomy was performed and a tumor 2 1/4 inches in diameter moderately firm, extremely friable, fish flesh appearance and not encapsulated was found. The vertebral bodies appeared very rough and invaded.

Following removal, roentgen therapy was instituted. The patient died 1 month after surgery.

#### VERTEBRAL CHANGES FROM TUMORS ARISING IN THE VERTEBRAL CANAL

Vertebral changes secondary to tumors arising in the vertebral canal have been described by several authors (Rix and Geschickter). Among our material we found 2 such cases. In 1, there was a meningioma that had produced widening of the interpedicular space of one vertebra. The other was a case of perineurial fibroma.

Perineurial fibromas have received different denominations (neurinoma solitary neurofibroma, gloma peripherique). According to Mallory and Penfield, they arise from the connective tissue surrounding the nerve fibers, and do not contain nervous elements.

They may be intrameningeal or extrameningeal or in some cases develop along a nerve root, thus producing the so called dumb-bell tumors. In the cervical and dorsal regions these tumors usually produce a progressive erosion of the laminae and give origin to great

extravertebral masses. However, in the lumbar region, they frequently remain intrameningeal throughout, and produce marked erosion of the vertebral bodies and neural arches (Camp Adson and Shugrue) (Fig 13).

The evolution is usually very slow giving rise to clinical signs of progressive cord compression if they remain intrameningeal.

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# CERVICOMEDIASTINAL AND MEDIASTINAL CYSTIC HYGROMAS

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**C**YSTIC hygroma of the neck is a well recognized entity Gross and Goeringer in 1939 reported a group of 27 patients bringing the total number in the literature at that time to approximately 225 cases. Although an uncommon lesion there are doubtless a considerable number of these cases which are not recorded in the literature in 1946 twelve cervical hygromas were excised at The Children's Hospital. In view of the marked tendency of these cystic masses to involve adjacent structures by direct extension one might anticipate a relatively high incidence of cervicomediastinal lesions. However a review of the literature reveals only 19 cases of cervicomediastinal hygromas. Intrathoracic hygromas without involvement of the neck, are even more rare. Sanes, MacManus and Scatchard reporting a case of cystic lymphangioma of the mediastinum in 1945, were able to find only 8 published apparently similar cases some of these on close inspection were probably not true hygromas. The lack of uniformity in the treatment of cervicomediastinal and mediastinal hygromas prompts this review of the subject with the report of 3 additional cases.

## REPORT OF CASES

**CASE 1.** No 293002 E. F. a 14 month old white girl, was admitted to The Children's Hospital on April 11, 1945. A mass had been present in the left side of the neck since birth and this had increased steadily in size. Physical examination revealed a well nourished child with normal development for her age. There was a large cystic swelling on the left side of the neck (Fig. 1) in the center of which was a small hard portion about 2 centimeters in diameter. The entire mass greatly increased in size when the child cried, and it decreased in size during inspiratory efforts. There were no abnormal physical findings related to the thorax or to the remainder of the body.

**Laboratory data.** The white blood count was 10,300. Urinalysis was negative. X ray and fluoroscopic

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examination showed a large round soft tissue mass of homogenous density in the left, upper part of the chest (Fig. 2). On expiration the mass was most prominent in the neck. On inspiration the major portion of the mass could be seen in the left side of the thorax. On digital compression of the cervical mass the mass within the thorax produced a fairly marked shift of the trachea and mediastinal structures to the right. There was no definite abnormality of the lungs.

**First operation.** On April 13, 1945 under avertin ether anesthesia, cervical exploration was performed. A large cystic hygroma in the left side of the neck was dissected out cleanly. It soon became apparent that the mass was a multilocular structure. There were 3 main components: one going to the base of the skull, one extending down beneath the left scapula, and a third extending into the mediastinum probably to the level of the heart. It was impossible to remove all intrathoracic portions of the cystic hygroma through this exposure. As far as possible the some remaining ones were swabbed with tincture of iodine in the hope of producing sclerosis. A small rubber drain was inserted into the mediastinum and the cervical wound closed about the drain. Postoperatively considerable amounts of fluid were expressed from the cervical wound daily for about a week. The child was discharged from the hospital markedly improved on the eleventh postoperative day.

**Pathology report.** The specimen consisted of 3 red yellow soft pieces of tissue containing multiple clear walled cysts filled with a yellow fluid. The cysts varied in size from 1 to 1.2 centimeters in diameter. Microscopic examination revealed multiple cystic, endothelial-lined spaces. These varied from large irregular cavities to small cysts (Fig. 3). Some contained smooth muscle in their walls, others had only connective tissue. Supportive structures contained variable amounts of fat. The findings were typical of cavernous lymphangioma (cystic hygroma).

**Second admission.** On August 6, 1946 16 months after the first operation the child was readmitted. She had made an uneventful recovery and had been relatively asymptomatic except for a poor appetite and slow weight gain until May 1946 at which time the mother noticed a swelling over the left upper chest posteriorly. The swelling appeared rapidly and was associated with some pain in the left arm. Physical examination disclosed a well healed left transverse cervical incision just above the clavicle. Percussion of the chest was normal except for a small area of dullness just to the left of the sternum. In the

TABLE L—CERVICOMEDIASTINAL HYGROMAS

Number	Author	Date	Age	Sex	Therapy	Result
	Dowd	1913	373	F	Resection of cervical portion and part of mediastinal extremity. Cervical recurrence—no later resected.	Dead, postoperative hemorrhage.
	Fajó Case	1919			Radiation to neck lesions.	?
3	Case	1919				
4	Case 2	1919			No therapy to thoracic portions (?)	
5	Case	1919				
6	Edouard	91	8 yrs	M	Resection through cervical approach	Improved
7	Martin and Lelong	1913		F	Partial resection	Improved
8	Michaels	911	8 mos.	M	Mediastinal portion resected.	Postoperative death
9	Langdon Case	917	8 yrs	F	Ectasis of cervical portion. X-rays to mediastinum	Improved. No recurrence 6 mos. later
	Case	917	8 mos.	M	Ectasis of cervical portion.	Dead, 30 mos. later of infection in mediastinal part.
	Gersbach	1918	8 yrs	F	Ectasis of cervical portion. X-rays to mediastinum.	Improved. Marked reduction in size of mediastinal shadow noted 7 years later
	Watson and McCarthy Case	1919			"Operation"	Dead
	Case				No therapy	?
14	Arabin Case	1913	7 mos.	M	Resection of cervical portion. Ectasis of mediastinal portion	Improved. Marked reduction of mediastinal shadow
5	Case	1913	5 mos.	F	Resection of cervical portion. Ectasis of mediastinal portion	Cervical recurrence excised. Improved.
6	Mann Gen. Hosp. Case no 3 of 4	913	mos.	M	Cervical part separated. Mediastinal part resected	Improved. Horner's syndrome
17	Perkins Case	1915	10 mos.	F	Resection	Death, hemorrhage.
8	Case	1915	733	M	(1) Incision and drainage of cervical part. (2) Resection of cervical portion and part of mediastinal portion (3) Radon seeds to mediastinal recurrence	Improved.
19	Serfl and Knoch	1916	11 yrs	M	Partially resected. Chrysothorium applied	Improved.
20	Geiss and Harwitz Case	918	4 mos.	F	(1) Resection of cervical portion (2) Resection of mediastinal portion (3) Erection of subcapsular portion	Improved.
21	Case	1918	7 mos.	F	Resection of cervical portion. Ectasis of mediastinal portion	Improved.

\*Two cases reported by Lenson in 1911 presumably had been included in the previous report by Fajó (Personal communication, Mayo Clinic.)

left posterior chest wall was a freely movable ovoid cystic mass measuring about 5 centimeters in its long axis (Fig. 1).

**Laboratory data.** The red blood count was 3,680,000 and the hemoglobin 86 per cent. Urinalysis was normal. X-ray examination of the chest showed a persistence of the shadow in the left upper portion of the chest. This extended from the superior mediastinum out into the apex of the left pleural cavity.

**Second operation.** On August 7, 1916, under cyclopropane anesthesia, thoracic exploration was performed. The left pleural cavity was entered through

the third interspace anteriorly. In the upper part of the pleural cavity was a cystic mass somewhat larger than a golf ball, some portions of it were quite thin whereas others appeared to be distinctly thickened and scarred. The mass presented below the thoracic inlet and extended along the lateral aspect of the mediastinum to the root of the lung, the lung was not involved. The overlying parietal pleura was incised and the phrenic nerve dissected away from the anteromedial border of the hygroma. The vagus nerve was not adherent to the hygroma. The mass was dissected free from the aorta, the left subclavian



Fig 1. Case 1. Above, Photograph of 14 months old girl with a large cervicomediastinal hygroma. The cervical swelling was prominent during crying or straining, but most of it disappeared when the child was quiet, especially during inspiratory periods. Below Photograph 16 months after surgical removal of cervicomediastinal hygroma, now showing development of a posterior thoracic (subscapular) hygroma. (Compare with Fig 5)

artery and the left innominate vein. The internal mammary artery and vein were divided and sections of them were removed with the hygromatous specimen. At the thoracic inlet some small cysts were cut across and minute bits of hygromatous tissue were left in place to avoid running the risk of injury to

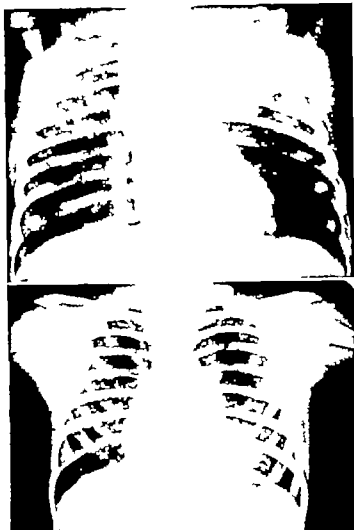


Fig 2. Case 1. Above Roentgenogram of the cervicomediastinal hygroma, showing the mass of uniform density in left upper part of the thorax and with a slight displacement of mediastinal structure to the patient's right. Below Roentgenogram, following removal of thoracic hygroma.

important anatomical structures at the base of the neck. The chest wall was closed in layers the lung being expanded before the closure was completed. The patient stood the procedure extremely well and was returned to bed in good condition. Convalescence was uneventful. The wound healed by primary union.

**Pathology report.** The specimen consisted of a multicystic reniform piece of tissue measuring 5 by 4.5 by 1.5 centimeters. Microscopic examination revealed multiple cysts fatty and connective tissue and numerous small blood vessels (Fig 4). In the supporting tissues there were small nests of lymphocytes. In contrast to the cervical cysts which had been previously examined this thoracic specimen showed a much more abundant connective tissue in the walls of the cysts.

**Third operation.** On August 17 the cystic mass in the left posterior chest wall was removed. This was situated deep to the levator scapulae muscle and lay on the rib cage, running out beneath the scapula. It had only a filmy attachment to the underlying





Fig 3. Case . Photomicrographs of cervical component of hygroma. Above, Low power showing the multicystic architecture. Below Higher power indicating the character of cyst wall.

ribs and could be removed without difficulty. The patient tolerated this last procedure extremely well and was discharged from the hospital on the following day.

**Pathology report.** The specimen consisted of a cystic irregular egg-shaped mass measuring 4 by 5 by 1 centimeter (Fig. 5). The capsule consisted of dark gray fairly tough tissue. The cyst was filled with thick, dark red brown fluid. On microscopic examination a multicystic mass was seen, with a dense interlacing fibrous stroma. In some areas were small nodules composed of endothelial cells, with a rather high degree of cellularity (Fig. 6). There was a light infiltration of lymphocytes. Numerous large vacuolated phagocytes were present, some containing large amounts of hemosiderin, others being laden with lipid material. The findings were those of a cavernous and capillary lymphangioma and also a more rapidly growing lymphangioblastoma.

**Follow-up note.** Examination of the patient in November 1947 showed all the wounds to be well healed and the patient to be in good condition. There was no swelling in the neck or in the left scapular region. A roentgenogram of the chest was essentially normal.



Fig 4. Case . Photomicrograph of mediastinal component of the hygroma. Above, Low power revealing the intimate relation of the cysts to large blood vessels. Below Higher power showing the endothelial lining of the cystic cavities.

**CASE 2.** No. 301086 B. M., a 7 month old white female was admitted to the Children's Hospital on January 8, 1946. The baby was born with a small nubbly of cystic tumor on the right side of the neck, which had increased rapidly in size until now it was larger than a goose egg. The parents had noticed that the mass increased in dimensions whenever the baby cried and it would almost disappear when the baby inspired. For 2 weeks prior to admission the baby had vomited frequently and had lost 4 pounds. On physical examination a lobular cystic mass was noted on the right side of the neck measuring about 10 centimeters in diameter (Fig. 7). This was soft and could be compressed and held down within the normal contour of the neck.

**Laboratory data.** Film and fluoroscopic examination showed a large round soft tissue mass of homogeneous density in the right side of the neck. This extended through the circle of the first rib into the mediastinum and pleural cavity on the right side (Fig. 8). On deep inspiration the mass descended almost entirely into the chest and during expiration it was very prominent in the neck. There was a moderate lift of the esophagus and trachea to the left. In a lateral view of the neck a considerable amount of the hygroma lay behind the pharynx. The trachea and larynx were markedly displaced forward (Fig. 9).



Fig 5 Case 1 Cystic mass removed from posterior chest wall (subcapular area)

**Hospital course** Because of an intercurrent respiratory infection and otitis media, operation was deferred and chemotherapy was given.

**Operation** On February 12 1946 operation was performed under ether anesthesia. A long transverse incision was made in a fold of the skin over the presenting mass. The platysma sternomastoid and ribbon muscles as well as the omohyoid were divided. A large irregular smooth multiloculated hygroma was encountered. During the operation there was a good deal of tracheal compression and intermittently there was obstruction of the airway. It seemed wisest to open the main cyst in order to collapse it. When this was done several ounces of thin bloody fluid escaped and the respiratory difficulties completely disappeared for the remainder of the procedure. There were several large smooth walled cavities which intercommunicated all of which collapsed when the main cyst was opened. By digital examination one could feel a finger-sized projection upward along the carotid vessels to the base of the skull. There was also a large finger-sized projection behind the carotid sheath extending posteriorly well behind the mastoid region. Another projection went downward into the thorax and a palpating finger in the opened cyst could be passed inferiorly as far as the lung root. The mass filled about the upper third of the pleural cavity. With meticulous care all of the cyst membranes in the neck were dissected out. The removal of the membrane in the thorax seemed too hazardous because of the danger of damaging adjacent important anatomical structures such as the vena cava. Hence the entire lining of this mediastinal portion of the hygroma was diffusely swabbed with tincture of iodine in the hope of destroying its lining membrane. A small rubber wick was led down into this cavity to allow for the escape of any fluid and thus permit coalescence of the cyst walls. The neck wound was closed in layers about the drain.

**Postoperative course** The patient began taking fluids on the second postoperative day. She took increasing amounts of feeding without difficulty and gained 1 pound in the first 2 postoperative weeks. On 3 occasions accumulations of cystic fluid in the

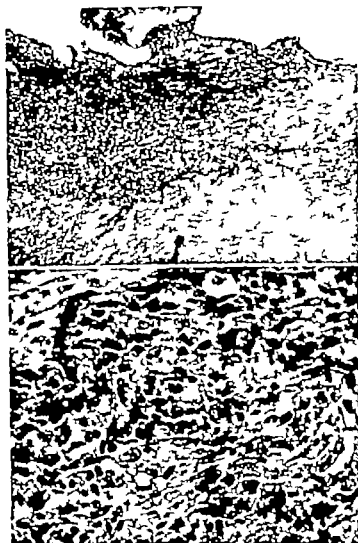


Fig 6 Case 1 Photomicrographs from specimen shown in Figure 5. Above, The transition between simple hygroma and cellular lymphangioendothelioma is evident. Below, From endotheliomatous area, showing cellular portions differentiating into capillary spaces.

cervical region were aspirated approximately 5 cubic centimeters of reddish fluid being obtained each time. The child was discharged from the hospital on the eighteenth postoperative day afebrile and in good condition. She was last examined in November 1947 at which time she had gained weight and looked very well (Fig 9). The neck appeared normal. Roentgenogram of the chest showed only a slight thickening on the right side of the superior mediastinum.

**CASE 3** No 12277 R.F. A 32 year old white male salesman was admitted to the Peter Bent Brigham Hospital on December 1 1945. Seven weeks previously attempting to enlist in the Navy he was found to have a mediastinal shadow by routine x ray examination. He had been completely asymptomatic. On physical examination an area of decreased breath sounds and dullness was found to the right of the sternum from the third to the fifth interspace anteriorly extending laterally for about 5 centimeters



Fig 7. Case 1. Above, Photograph of 7 months old girl with right-sided cervicomedastinal lymphoma. The cervical mass varied in size during respiratory movements. Below, Lateral roentgenogram of neck, showing marked anterior displacement of trachea.

No cardiac abnormalities were elicited. The blood pressure was 8/80.

*Laboratory data.* White blood count was 7,600; red blood count, 4,560,000; hemoglobin, 80 per cent

Fig 8. Case 1. Above, Preoperative roentgenogram during inspiration, demonstrating the dense mass in right upper part of the thorax. Middle, Preoperative roentgenogram during expiration showing displacement of greater part of the mass up into the neck. Below, Postoperative film after transcervical cauterization of mediastinal lymphoma. The slight remaining shadow is believed to be dense sclerosed tissue.

urine normal. The blood Hinton test was negative. X-ray examination of the chest, including roentgen-



Fig. 9. Case 2. Photograph following surgical excision of the cervical hygroma and transcervical chemical sclerosis of mediastinal projections of the mass.

okymography of the heart showed a discrete shadow in the right anterior mediastinum suggesting a benign tumor or cyst (Fig. 10).

**Operation.** On the second hospital day, under positive pressure ether anesthesia, operation was carried out. The right pleural cavity was entered anterolaterally through the fourth interspace after dividing the fourth, third, and second costal cartilages. A cyst the size of two clenched fists bulged from the anterior mediastinum toward the right and projected into the pleural cavity. It lay on the pericardium to which it was lightly adherent. It reached posteriorly as far as the phrenic nerve and extended from the diaphragm well up to the great vessels. The mediastinal pleura which covered it was divided and the cyst was freed from the mediastinal structures. There was very little bleeding during the dissection. The chest wall was repaired in layers; the right lung being completely expanded before completing the wound closure.

**Pathology report.** The specimen (Fig. 11) consisted of a large cystic mass measuring 13.5 by 9 by 6.5 centimeters. (Because of the escape of fluid, the original size had been larger than this.) The mass was irregularly round in shape and soft in consistency. Its external surface was pinkish-gray in color and presented a few loose fibrous adhesive tabs. In general, the walls were thin, but in a few places they were thick and rather tough. The contained fluid was clear and amber colored. The interior of the cyst showed a multilocular structure, the various compartments of which communicated with one another. Microscopic examination showed a typical hygroma

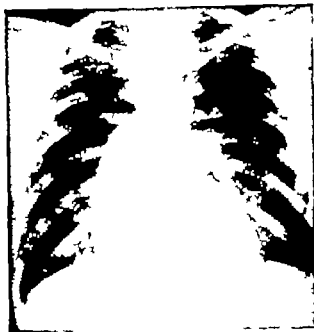


Fig. 10. Case 3. Preoperative roentgenogram of mediastinal hygroma in a 32 year old man. Right border of the mass is slightly lobulated, smoothly outlined and obscures the right border of the heart.

the walls of which were formed by loose connective tissue, the spaces being lined by an endothelium.

**The postoperative course** was uneventful. The sutures were removed on the fifth day and the patient discharged afebrile and asymptomatic on the tenth day. X-ray examination on December 11 showed that the large mass previously noted on the right border of the heart had been completely removed.

The patient was last examined on February 21, 1944, by which time he had gained 27 pounds, he ap-

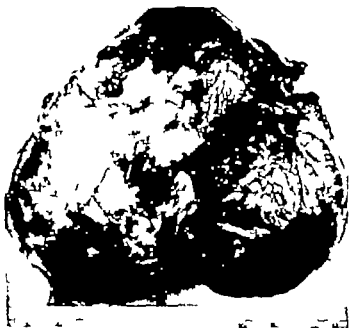


Fig. 11. Case 3. Photograph of surgically removed mediastinal hygroma.

TABLE II—MEDIASTINAL HYGROMAS

Number	Author	Date	Age	Sex	Organ involved	Therapy	Result
	Seidel	1904	77½		Thymus	Found at autopsy	
	Flaschewski	1909	20 yrs	M	Pericardium	Found at autopsy	
3	Leskelt	1910	80 yrs	F	Epicardium	Found at autopsy	
	Kramer and Hobbs	1916	7 yrs	M	Intercostal vein on Diaphragm Thymus Pericardium	stare resection	Improved
	Brown	1916	23 yrs	M	Diaphragm Pericardium	Resection	Improved
	Saunders et al	1915	20 yrs	M	Between trachea and esophagus	Resection	Improved vocal cord paralyzed
	W. Linn (Jr.) and Diamond	1917	21 yrs	M	Trachea Superior vena cava	Resection	Improved
8	Green and Harvett	1918	13 yrs	M	Pericardium	Resection	Improved

peared to be in excellent health. Three years later, upon application for life insurance the patient had no complaints and there were no abnormal physical findings.

#### ETIOLOGY

These cystic hygromas may properly be classified among the congenital malformations. The lymphatic system is derived by a growth and coalescence of the lymphatic sacs or buds and their extensions. These buds develop either as outpocketings of the venous system (Sabin) or they are formed from mesenchymal deposits (Huntington). An arrest or pinching off of any part of these processes may predispose to the formation of cystic structures with the capacity for continued independent growth. The most common primary sites of hygromas, namely the cervical axillary and much less frequently the inguinal regions coincide with the areas in which the lymphatic buds are known to be normally present in embryos.

The mechanism whereby hygromas may be found in the mediastinum either with or without a cervical component has not been completely explained. Eagler and Michaelis have suggested that intrathoracic lymphangiomas, cysts or cystic hygromas have grown downward from the neck. In those cases with frank involvement of both the neck and the mediastinum such an extension would seem obvious. There are however mediastinal hygromas with no demonstrable cervical connections. In these cases while it is conceivable that a cervical component might have been

present originally the possibility of an independent origin within the mediastinum must also be admitted.

#### PATHOLOGY

Hygromas are characteristically thin walled cystic structures lined by endothelium. Although occasionally unilocular for the most part they are multilocular the subsidiary cysts having a variety of sizes and shapes. Many of the cysts may intercommunicate whereas in other areas septation may be complete. The multilobulated appearance of the cysts in the gross is caused by these septa. Puncture of one portion of the mass with release of fluid may or may not result in collapse of the entire structure, depending on the degree of completeness of compartmentation. The fluid is usually thin and colorless when there has been superimposed hemorrhage the fluid may be xanthochromic or frankly bloody.

A variety of structures may be incorporated into different portions of the cyst walls ranging from connective tissue and strands of smooth muscle to fat blood vessels and nerves. The most plausible explanation for the presence of foreign elements such as nerves is that suggested by Goetsch. The cysts enlarge by a process of endothelial sprouting. These buds extend along tissue planes insinuating themselves between and around any structure in their path, and the buds subsequently enlarge to sizable cysts. In this way a vessel or nerve, actually surrounded by cystic prolongations, may appear to be traversing the cystic mass.

It is this intimate involvement of regional tissues that may cause almost insurmountable technical difficulties in surgical dissection.

A distinction between cystic hygromas and cavernous lymphangiomas has been postulated on the basis of the widespread occurrence of the latter in various regions of the body with out the development of features which have been described as characteristic of hygromas. While such a distinction may be valid in the case of lymphatic malformations in superficial areas of the body it can hardly apply to the mediastinum. It is our belief that the terms cavernous lymphangioma and 'cystic hygroma' describe the same pathologic process or malformation but that the latter merely indicates a much greater tendency to development of compartments of large size.

In 1940 Lambert, during a discussion of the etiology of thin walled thoracic cysts pointed out the necessity of distinguishing between the multiloculated hygromas and other varieties of mediastinal cysts. He described the hygroma as being composed of a conglomerate mass of individual cysts of differing sizes intimately associated with various structures in the vicinity and presenting no sharp line of cleavage from regional organs. These were contrasted with the simple monolocular mediastinal cysts situated in relation to the pericardium which shell out readily. Lambert considered the latter so-called endothelial or celomic cysts to come from embryologic derivations in the formation of the pericardium and concluded that some of the cases previously regarded as mediastinal cysts of lymphatic origin probably belonged to this category. The reports of Dufours and Mourrut, Pickhardt and of Eigler are examples in point.

#### CLINICAL FEATURES AND DIAGNOSIS

Hygroma of the neck usually is noted at birth although a later onset is sometimes seen. The soft poorly defined swelling is most commonly present in the posterior cervical triangle although the mass may appear anywhere from just above the clavicle to beneath the mastoid process. Extension from the neck to the axilla or into the floor of the mouth has been noted as has an engirdling prolongation beneath the mandible from one side of the

neck to the other. Aside from the unsightly appearance of such a mass associated symptoms are usually few unless there should be sufficient displacement of the trachea or esophagus to cause interference with breathing or swallowing. When a cervical hygroma is small it must be differentiated from other causes of cervical swelling such as a branchial or thyroglossal cyst, lipoma, deeply situated hemangioma, lymphadenopathy or herniation of the lung. When a cervical hygroma is large there is little difficulty in recognizing it because of its great size, its thin walls, its translucent character and its soft flaccid consistency.

Recognition of a cervicomediastinal hygroma is made by physical examination of the cervical swelling supplemented by roentgenographic examination of the chest. A soft tissue shadow in the neck connecting with a mass in the mediastinum or upper pleural cavity should suggest strongly a common etiologic background. Periodic fluctuation in size has frequently been observed in cervical hygromas. This is even more characteristic of the combined cervicomediastinal lesions in which the cervical component may be seen to increase in size during acts of crying, grunting or expiratory efforts and conversely to decrease in size during inspiratory movements. X-ray film and fluoroscopic examination may show descent of the mass into the mediastinum on inspiration whereas there is a prominence in the neck during expiration (Fig. 8). Lateral and anteroposterior films of the cervical region will reveal the direction and extent of displacement of the regional structures. Although the thoracic prolongation may extend only into the superior mediastinum descent to a level as low as the eighth thoracic vertebra has been recorded by Arnheim. There has been no consistent correlation between dyspnea or dysphagia and the presence of a mediastinal component, these symptoms being an indication of the degree of mechanical compression which is present in a given case.

The finding of chylothorax by Swift and Neuhoef associated with a cervical hygroma, and suggesting lymphangiomatous involvement of the thoracic duct is unique. These authors again point out the relationship between an upper respiratory infection and the

onset of acute symptoms in a case of hygroma. In a young subject a hygroma may become the focal point for the development of either a severe regional infection or a wide-spread sepsis, and constitutes a strong reason for instituting therapy before such complications can occur.

Cystic hygromas which have been confined to the mediastinum have usually been discovered either at autopsy or as unanticipated findings during x-ray examinations. This lack of symptomatology is probably related to the soft and yielding nature of the cysts which can obtain considerable size without giving sufficient pressure on regional organs to produce symptoms. An exception to this generality is provided by the report of Skinner and Hobbs who described a boy with dyspnea orthopnea nonproductive cough and "tightness" in the chest.

While the roentgen film may demonstrate a slightly lobulated smoothly outlined mass it is usually not possible by this means to distinguish hygromas from other benign tumors or cysts of the mediastinum such as duplications of the esophagus bronchial cysts dermoids and teratomas pericardial celomic cysts or tumors of the thymus gland (Laipply).

As the result of the roentgen survey of millions of young men and women during the war years one might have expected the detection of an appreciable number of mediastinal hygromas. In this light it is surprising to note that Blades in his report of 100 patients with mediastinal tumors collected from various Army chest centers found no hygromas; it is possible that some of the pericardial cysts included in his series might have been hygromas. The publication by Watson and Diamond (31) on surgical thoracic tumors in Navy personnel lists only one cystic hygroma. (The fact that a mediastinal shadow constituted a lesion which disqualified a subject from military duty may have been an explanation for the rare appearance of thoracic hygromas in the previously mentioned series which were gleaned from military personnel.)

#### TREATMENT

The presence of an unsightly mass in the neck of a child provides an obvious source for

parental anxiety and it is for cosmetic reasons that a surgical consultation is most frequently requested. In more rare cases the presence of acute symptoms resulting from compression of mediastinal structures or of the cervical part of the trachea demand immediate surgical intervention. Arnheim reported a case in which relief from asphyxia was so imperative that operation was performed by Neuhof immediately after admission to the hospital with the child in a sitting position and without the use of inhalation anesthesia.

In addition to the cosmetic considerations and to the occasional relief of respiratory embarrassment it is important to remove hygromas to prevent complications which are so apt to occur in the untreated lesions. Hygroma frequently become infected in the course of respiratory infections. While such infections may subside under chemotherapy or after incision and drainage the risk of an overwhelming local or blood stream infection is great. One of Singleton's patients (Case 28) died of infection in the mediastinal portion 10 months after the cervical component had been resected. While it is true that infection is sometimes followed by local fibrosis and disappearance of the mass such a favorable outcome is seldom encountered and it does not justify an attitude of expectant treatment. Spontaneous or posttraumatic hemorrhage into a cyst may result in marked distention of the same give sudden appearance of tracheal compression and lead to a surgical emergency. While the occurrence of malignant change in a hygroma has not been reported this theoretical possibility adds another indication for prophylactic therapy.

There has been little difference of opinion concerning the proper approach to the lesions which are confined to the mediastinum. Exploratory thoracotomy offers the surest means for making a differential diagnosis and certainly gives the best opportunity for definitive treatment. Fortunately mediastinal hygromas can usually be excised with little difficulty because well developed tissue planes around the cysts facilitate their enucleation. Certainly when a hygroma bulges well out into either pleural cavity its surgical removal is not apt to be difficult. However when a cystic

mass insinuates itself between mediastinal structures the dissection might be hazardous—a fact commented upon by Sanes and his associates when dealing with a hygroma lying between the trachea and esophagus. In treating hygromas one must be always mindful of the excellent studies of Goetsch who pointed out the tendency of a hygroma to enlarge and envelop structures (particularly nerves and blood vessels) which lie in its path. Thus nerves such as the vagus and phrenic may become completely surrounded by hygromatous tissue. To maintain the integrity of such nerves it is frequently necessary to leave minute bits of hygromatous tissue along their surfaces but this does not necessarily militate against a successful outcome since an extensive experience with surgical treatment in cervical hygromas has convinced us that small remaining islands of lymphangiomatous tissue will probably become sclerosed and will not give rise to subsequent troubles.

Cervicomedial hygroas are apt to be much more difficult to treat than are those cysts which are situated completely within the thorax. Provided there are no complicating factors which require immediate attack on the intrathoracic portion the combined lesions are best handled by first directing attention to the cervical part, which should be treated by meticulous dissection and removal of the cyst or cysts having due regard for preservation of important anatomical structures. This choice of action provides the advantage of being able to continue the dissection down through the thoracic inlet to remove all or part of the hygroma which resides in the chest. The feasibility of this technique was commented upon by Eloesser, Martin and Lelong and Swift and Neuhof. It is further indicated by the favorable use in our first and second cases. If the hygroma has previously made a large opening through the thoracic inlet this provides an avenue of considerable width for carrying the surgical dissection downward to remove the intrathoracic projections provided the latter are not too large and are not attached to mediastinal viscera. Under favorable circumstances it might be possible to remove all of the intrathoracic part of the hygroma. More frequently it will be found that considerable

remnants remain within the chest and can be treated by (1) leaving them for a more adequate and a wider exposure through a subsequent thoracotomy (our case 1), or (2) continuing the initial operation by introduction of sclerosing agents down through the cervical wound (our Case 2). By this latter technique remaining cysts in the thorax can be broken into (via the cervical wound) and can be swabbed out with some irritating substance (such as tincture of iodine) to destroy the lining membranes. If such cauterizing substances have been used a soft rubber drain should be led down into the depths of the wound and left in place as long as there is any drainage in the postoperative period. (Failure to insert a drain will almost certainly be followed by postoperative reaccumulation of fluid within the cystic spaces and a reappearance of a smooth lining in many of them. In contrast the institution of external drainage will allow the inflamed walls of the cavities to coalesce and the spaces will thereby be obliterated.)

While we recommend treatment of cervicomedial hygroas by (1) separate operations in the neck and thorax and (2) by excision of the cervical portion and simultaneous sclerosis of the intrathoracic part—and have been completely satisfied with the result in either instance—it is well to call attention to the favorable results reported by Singleton and Goetsch wherein excision of the cervical portion was followed by x ray therapy to the mediastinum and also the procedure described by Portmann wherein radon seeds were applied to the mediastinal remnants.

#### SUMMARY AND CONCLUSIONS

The clinical and laboratory findings of cervicomedial and mediastinal hygroas have been reviewed. The successful management of 2 additional cases of cervicomedial lesions and 1 mediastinal cyst is reported.

The cervical portions of hygroas are best treated by a meticulous dissection and removal of the cystic structures. Whenever possible treatment of the thoracic lesions is preferably done by complete extirpation of the presenting mass. Under some circumstances a cervicothoracic hygroma can be treated by



surgical excision of the cervical portion and transcervical approach to the intrathoracic portion the latter being treated by intense chemical sclerosis followed by external drainage. If such therapy is followed by persistence or recurrence of the intrathoracic component thoracotomy for excision of the remaining hygroma is indicated.

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## URETHRAL CARUNCLE

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URETHRAL caruncle was first described by Sharp in 1750. Since his first description of this condition there has been much controversy concerning its etiology, pathology, classification and treatment. This diversity of opinion concerning a clinical entity which is so common stimulated our interest to investigate this subject. Accordingly we have made a clinical and pathologic study of 120 cases of urethral caruncle. The results of this study together with a review of the literature on this subject, form the basis of this paper. Inasmuch as a complete review of the literature on this subject has not been made for a number of years, our review has been made comprehensive.

### REVIEW OF THE LITERATURE

*Embryology and anatomy* According to Arey the caudal segment of the cloaca that separates from the rectum becomes the primitive urogenital sinus. In the female the originally short neck between the bladder and the urogenital sinus elongates into the permanent urethra.

The gross anatomy of the female urethra is well described by Williamson and Atlee.

The female urethra is a narrow membranous canal about 4 centimeters long, extending from the internal to the external urethral orifice. Its diameter when undilated is about 6 millimeters. However the caliber is not uniform the urethra being somewhat fusiform in shape. It is capable of great dilatation. The female urethra is located behind the symphysis pubis imbedded in the anterior wall of the vagina, and its direction is obliquely downward and forward; it is slightly curved with the concavity directed forward.

The external urethral orifice is usually shaped like an inverted V and is situated di-

rectly in front of the vaginal opening and about 2.5 centimeters behind the glans clitoridis on the summit of a small eminence. Around the meatus are seen a number of small apertures which are the openings of the perineurethral glands. Skene's glands usually open on the floor of the urethra some little distance from the meatus. Each aperture is surmounted by a small hoodlike fold of mucous membrane so arranged that the orifices are valvular in nature.

When the urethra is opened longitudinally it can be studied thoroughly. The lining membrane is found to be thrown into longitudinal folds which are close together at the meatus but radiate outward from one another as the urethra widens. The number of folds seen is variable but is usually five. In the region of the meatus these folds are united by a number of transverse ridges thereby forming numerous crypts or depressions into which open the large urethral glands.

The peculiarly rich vascular supply which the urethra possesses is contributed to by the internal pudendal, the inferior vesical and the vaginal arteries. The plexus of Santorini above and the plexus of veins surrounding the base of the clitoris below lie in close relationship with the urethra. Together with their communications they constitute an investment of venous spaces throughout the greater part of the length of the canal. The lymphatics drain into the inguinal and pelvic nodes.

The nerves are derived from the hypogastric plexus of the sympathetic and from the sacropudendal plexus.

*Histology* The histologic characteristics of the female urethra are well described by Maximow and Bloom, by Smith and by Gray.

The urethra consists of three coats: (1) mucous, (2) submucous and (3) muscular.

1. The mucous coat is pale; it is continuous externally with that of the vulva and internally with that of the bladder and, as mentioned previously, is thrown into folds. The epithe-

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lium varies considerably in different individuals near the bladder it is usually transitional and the remainder of the urethra is lined mainly by stratified squamous epithelium with areas of stratified columnar or pseudostratified epithelium.

2 The submucous coat is very vascular capillaries and large blood spaces abounding. Some of these are located close to the epithelium and in some cases encroach on the basement membrane. Microscopically the submucous coat is found to be composed of a loose connective tissue with an abundant elastic network which is provided with a highly developed system of venous plexuses and has, therefore a cavernous character like the corpus spongiosum. In this coat the urethral glands are found. Each one has a number of branches which communicate with the surface by a common duct. The glands usually have a distinct lumen but occasionally they appear in section as solid masses or columns of cells. They are found throughout the circumference of the urethra and are not limited to the posterior wall as some authors have stated.

3 The muscular coat part of which is continuous with that of the middle circular layer of the bladder wall extends the whole length of the tube and consists of a nonstriated internal longitudinal layer and a nonstriated outer circular layer. The involuntary sphincter of the urethra or bladder is formed by additional muscle fibers which partly surround the posterior portion of the urethra at the internal orifice. Between the layers of the triangular ligament or urogenital diaphragm the canal is surrounded by a layer of superficial striated, voluntary muscle fibers the compressor urethrae or sphincter urogenitalis.

*Etiology* Since Sharp's original article in 1750 in which urethral caruncle was mentioned many hypotheses have been offered to explain the causation of this condition. No one hypothesis or group of hypotheses has offered a satisfactory explanation therefore most of them will be mentioned in this paper.

Gregoire gave the following explanation based on the embryologic development of the urethra. The meatus and urethra are formed from different anlagen as are the anus and rectum and the hymen and vagina. The corpora

spongiosa form a ring around the orifice of the urethra as well as the vagina. In the process of embryologic development this ring becomes fibrous in the greater percentage but persists in others (Pozzi).

Répiton Préneuf theorized that the various causes of congestion in the female genital apparatus are contributing factors to caruncle formation. Simpson stated that caruncles resemble internal hemorrhoids. Richet and Hutchinson agreed with this and felt that their origin is similar. Goodell thought very much along the same line. He stated that congestion of the urethral plexus of veins as from overdistension of the bladder pressure of the gravid or displaced uterus or like causes is largely responsible the condition resembling hemorrhoids in its origin. In Rose's opinion caruncles are associated with urethroecies which have a direct bearing on their etiology.

Ferner based the causation of urethral caruncle on ruptured cysts of Skene's ducts. He brought out the point that caruncles practically always occur on the lower margin of the urethral meatus just where Skene's ducts open. Carter stated that rupture of retention cysts of Skene's ducts is a causative factor. Olcott also expressed the belief that Skene's glands play a major part in the formation of urethral caruncles.

Gutierrez discussed infection and chronic inflammation—in the form of leucorrhea, pads used during menstruation erosions traumatism incidental to coitus and childbirth and lack of proper local hygiene—as the chief causes of urethral caruncle. According to Gregoire the retention of droplets of urine in the urethral canal as well as of normal or abnormal secretions is a probable source of chronic urethral irritation. Olcott emphasized childbirth as a cause on the basis of its relationship to infection. Crenshaw stated that from his study only one definite conclusion as to causation could be drawn. This is that urethral caruncles seem to be secondary to a chronic irritation or ulceration of the urethral mucosa. Much emphasis was placed by early writers on gonorrhea as the causative factor.

McKim Smith and Rush stated that the cause of urethral caruncle has never been def-

initely proved. They attempted to correlate the pathologic with the clinical findings with out much success. They drew the following conclusions from their 202 case studies:

1 Vaginal discharge specific or otherwise, and sanitation can be eliminated as having little or no bearing on the direct causation of caruncles.

2 Some caruncles were found to be the direct result of trauma.

3 Intraurethral caruncles frequently were found behind tight urethral meatuses.

Novak (31) offered the following explanation:

1 The caruncle develops from an ectropion of the posturethral wall and is caused by post menopausal shrinkage of the vaginal tissue.

2 All the further changes of the everted mucosa are secondary and are caused by the altered environmental conditions.

3 There is no relationship to former inflammation of the urethra or the bladder.

*Symptomatology.* There are few lesions of the entire body which have had so many terms used to describe them. This is based on the symptoms which are out of all proportion to the size of the lesion.

One of the most common symptoms is severe pain which has been described as 'scalding', 'stabbing', 'shooting', 'cutting', and 'burning'. It has been variously described as being referred to genital organs, hypogastrium, perineum, kidneys, rectum, bladder, lumbosacroiliac region, and soles and heels of feet. The pain is said to be produced by micturition, sitting, walking, coitus, touch, menstruation, and friction from clothing, napkins, and so forth. Levant and Gutierrez stated that the pain is occasionally so great that the patient puts micturition off until the urge becomes unbearable leading to dribbling and incontinence. Occasionally the discomfort is so great that it leads to neurasthenia, loss of weight, insomnia, despondency, melancholia, and other mental disturbances. On the other hand some caruncles are painless.

Another prominent symptom of the urethral caruncle is bleeding. The blood is usually seen at the beginning or end of urination following coitus, friction from clothes or pads following trauma, and on toilet tissue. It is usually spotty

—that is, there are only a few drops at a time—but occasionally it may be so profuse that the patient thinks she is menstruating irregularly. The first noticeable finding may be a small tumor mass and this may be the only symptom which brings the patient to the physician. Other symptoms are division of the urinary stream, urinary frequency, nocturia, and pruritus. Any one or all of the foregoing symptoms may be present. The duration of these symptoms is very variable for example in Walther's series they varied anywhere from 48 hours to 20 years.

*Clinical picture and classification.* This lesion occurs only in the female urethra. It is found almost exclusively between the ages of 20 and 60 years although rarely it has been reported in children. Gutierrez reported that 33 per cent of his series of 27 patients were multiparas between 50 and 60 years of age. Walther reported 65 cases in which the patients were between the ages of 23 and 84 years and only 1 patient was unmarried.

The gross appearance of urethral caruncle has been described as vividly as the symptoms. Herman in an excellent clinical lecture in 1892 on urethral caruncle described it as a bright red growth like a miniature "cock's comb" or like a very small raspberry springing from the lower margin of the meatus urinarius. It has since been variously described as a small pink or red growth with an irregular surface and vascular consistency' by Walther, a small benign polypoid growth by McKim, Smith and Rush, a small, red pedunculated or sessile vascular tumor' by Stevens and others.

The size may vary from that of a pinhead to that of a walnut but the caruncle is usually the size of a pea. It is usually single but may be multiple.

Urethral caruncles may be classified according to location, gross appearance, and microscopic appearance. Gutierrez divided them into three topographic types: (1) those external to the meatus, (2) those internal to the meatus, and (3) mixed, those partly within and partly outside of the meatus. Stevens classified them as sessile or pedunculated in appearance. Novak (30) stated that there are three chief types based on the histologic struc-

ture the granulomatous variety made up of granulation tissue the papillomatous variety which has the general structure of other papillomas with a lobulated treelike pattern and the angiomatous or telangiectatic variety which differs from the second type only in the richness of the stromal blood vessels.

**Differential diagnosis** The term urethral caruncle has become a clinical wastebasket into which most lesions of the urethra are placed. There are almost as many terms for describing urethral caruncles as there are articles on the subject. There has been a tendency for physicians to remove urethral growths as an office procedure and simply call them caruncles and forego any pathologic study. This has led in many cases to what is called a caruncle becoming malignant, because at a later date a biopsy revealed "carcinomatous changes." To be certain of the diagnosis microscopic examination of the tissue is imperative.

There are certain lesions of the urethra from which caruncles must be differentiated.

1. Urethral polyp is usually multiple and lies well up in the urethra. It is cystic, being filled with watery fluid.

2. Urethral papilloma is a definitely benign pluriglandular growth which may arise from any portion of the urethra.

3. Urethral prolapse—that is prolapse of the urethral mucous membrane—is a relatively common condition and is often termed "urethral caruncle." (This condition is included to make the differential diagnosis complete as presented by some authors, even though as will be shown our conclusions are not in agreement.) Urethral prolapse as a rule involves the entire circumference of the external urethral orifice. The tissue is pink to red, usually smooth and pouts from the urethra. It may be sensitive but not as much so as the majority of urethral caruncles and bleeding is not a common complaint. According to Ferrier actual shortening of the urethra may be apparent on endoscopy. This condition has been treated on innumerable occasions for urethral caruncle and when greater prolapse occurred after operation it was attributed to recurrence of urethral caruncle.

4. Urethral varicoities are supposedly blu-

ish of elastic consistency and readily reduced under compression.

5. Penurethral abscess as well as abscess of Skene's glands may strongly suggest a caruncle. The location in some cases may be almost identical and a tumor mass may be demonstrable with the symptom of marked tenderness. This lesion is definitely of an inflammatory character presenting a purulent discharge, increased heat, swelling and tenderness. It does not present the raspberry appearance so characteristic of the urethral caruncle.

6. Urethral carcinoma may be indistinguishable grossly from urethral caruncle in the early stages; that is, definite diagnosis will depend on microscopic examination. Statistically one is safer to call a lesion of the urethra a caruncle because primary carcinoma is infrequent, whereas caruncle is relatively common.

Walther emphasized the fact that primary carcinoma of the urethra is not as rare as most of us think. The age incidence of carcinoma of the urethra is the same as that of urethral caruncle. We must remember that these lesions can and do coexist and that urethral caruncles are not necessarily precancerous lesions. All of the symptoms which characterize the urethral caruncle may be present in a malignant lesion of the urethra. From this it is evident that the final differential diagnosis is left with the pathologist.

7. Urethral condyloma has to be included because it is seen and occasionally is confused with urethral caruncle. It has a warty and fungous appearance with a smooth skinlike surface. These lesions are usually multiple and are painless. The history may be of definite help in the diagnosis.

8. Urethral diverticula and urethroceles can be definitely identified and differentiated by urethroscopy.

**Histopathology** Urethral caruncle is a clinical rather than a pathologic term. However the condition is by no means rare and therefore constitutes a rather common diagnosis for the pathologist. The histologic structure is not constant a fact which explains the diversity of pathologic terms used to designate urethral caruncles as papillary angioma, vascular polyp, capillary angioma, urethral hemor-

rhoids adenoma, granuloma and others. The marked vascularity and inflammatory reaction are most commonly noted and mentioned. The controversy as to whether the urethral caruncle is always benign or potentially malignant still exists.

According to Bell the urethral caruncle is a vascular growth of the meatus and may be either pedunculated or on a broad sessile base. It is a chronic inflammatory lesion composed chiefly of dilated vessels and plasma cells. The surface is covered by stratified epithelium and glands are present in the growth. It may be mistaken for carcinoma. Caruncle is a fairly common lesion but carcinoma in this situation is very rare.

Boyd agreed essentially with the foregoing as did Karsner.

Foot described the caruncle as taking one of two forms: it may be granulomatous and belong to the category of chronic inflammations or it may be adenomatous and constitute a small adenoma in which case it is a neoplasm. The granulomatous type is a loosely knit mass of almost telangiectatic granulation tissue containing many leucocytes of the type that usually responds to chronic inflammation. The epithelial type may be adenomatous or it may take a papillomatous form and resemble an exaggerated leucoplakia or verruca.

Olcott stated that in 5 of his 23 reported cases epithelial infolding was found to a notable degree. This aroused suspicion that the growth was not entirely benign. The absence of definite invasion of subjacent structures, uniformity as regards size and appearance of epithelial cells and the fact that mostly they were properly oriented were all features which should dispose of the suspicions.

Fernier, Levant, Gutierrez, Carter and Meaker agreed with what has been quoted here. Quigley reported that of his 25 cases only 2 presented evidence of malignancy. McKim, Smith and Rush reported 202 cases without evidence of malignancy. Walther emphasized how imperative histologic study of urethral caruncles is in order to exclude urethral carcinoma which he insisted is by no means rare.

Auer identified the urethral caruncle as the predisposing factor in some of his cases of

urethral carcinoma. Menville and Counsellor reported a case in which a urethral malignant lesion was preceded 14 years earlier by a peculiar type of urethral caruncle.

Everett agreed with Bell that urethral caruncle may suggest carcinoma but explained that on more careful examination the uniformity of cell structure and lack of nuclear activity leave little doubt as to its benign nature.

Friedman and Ash also agreed as to the benign nature of the caruncle.

**Treatment.** It is important to realize that some caruncles respond to any treatment regardless of whether it is conservative or radical. Therefore for a true evaluation of treatment numerous patients should be treated and followed up. The method of treatment has varied little since 1857 as revealed by the following quotation from Scudder's *Diseases of Women*:

No means that may be made use of will have the least effect, until the tumor is removed; this may be done by ligature, caustic, the knife or scissors. Whatever means is adopted for removal of the tumor, without the base of it is destroyed by caustic, it will rapidly reappear as soon then as the tumor is removed, whether by the ligature or scissors; its base should be destroyed either by the application of nitric acid or a solution of the chloride of zinc carefully shielding the adjacent parts from injury. This should be repeated, at intervals until the disposition to reproduction has entirely ceased.

The methods of treatment presented in the literature will be summarized in this paper:

#### I. Conservative treatment

- a. Topical application of caustics such as silver nitrate or phenol, or soothing salves.
- b. Radium and roentgen therapy.

#### II. Radical treatment

- a. Simple fulguration.
- b. Simple excision.
- c. Removal with an electrosurgical knife or electric cutting loop or destruction with an electric needle.
- d. Urethroplasty.

#### III. Combination of conservative and radical methods

- a. Simple excision and cautery.
- b. Excision and radium or roentgen therapy.

**Conservative treatment.** a. Topical application of caustics has been used for a long time as evidenced by the foregoing quotation. Such medications as silver nitrate, phenol, or acid nitrate of mercury (liquor hydrargyri nitratis

acidus) are applied directly to the caruncle on several different occasions. A relative degree of symptomatic relief has been derived from such treatment, which is palliative in nature as pointed out by Meaker. Further or future treatment is based on recurrence of symptoms or recurrence of the tumor. Soothing salves and ointments have afforded relief in some cases.

b. Radium or roentgen therapy or the two together have many champions. Meaker stated that radium therapy has many successes to its credit but emphasized that burns should be avoided by the use of protective screens made of silver brass, and rubber. He stated that a small dosage of radium such as 25 to 30 milligrams applied for 2 to 6 hours according to the size of the tumor is adequate. Loucks advised the same.

Quigley reported that radium therapy had been used in 25 cases with 1 to 16 cures and that this is the specific treatment for urethral caruncles.

Radical treatment a. Most authorities agree that simple fulguration—that is, destruction of the caruncle by the use of the electric current—accomplishes little more than the local application of caustics because it is superficial in extent and thereby encourages recurrence. Levant, however, advocated the monopolar type of current for fulguration which he used if the caruncle was telangiectatic and for desiccation if the lesion was papillomatous or granulomatous. He stated that this method has the advantages that it requires only a short time and that there is no possibility of hemorrhage, no possibility of infection, no scar tissue, freedom from postoperative symptoms, rapid relief, and no need of hospitalization.

Ballinger and Elder used the d'Arsonval high frequency current until all of the red growth was whitened.

b. Simple excision of the caruncles with the scalpel or scissors has led to a high incidence of recurrence and has been abandoned as a complete procedure in itself.

c. Excision with an electrosurgical knife or electric cutting loop or electric needle is advocated by some. Gutierrez advised the removal of caruncles by electrosurgical resection, cutting and coagulating step by step. He used the following plan: procaine hydrochloride is

injected at four points around the lesion; the tumor is removed with an electric knife; coagulation of the wound is carried out with the electric needle for hemostasis. No hospitalization is necessary.

Walther used a similar procedure which he described as follows: overdilatation of the urethra with a Kelly cone dilator or mentotomy is carried out; a traction suture is placed through the base of the tumor; the electric cautery is brought firmly in contact with the base of the lesion; bleeding is controlled by a coagulating current.

Stevens advocated a similar procedure with close follow up and dilatation of the urethra at intervals to prevent formation of stricture.

d. Urethroplasty is the method of treatment accepted by many surgeons. All of the procedures and modifications will not be described. Deming described a well rounded procedure. He emphasized that the roots and ramifications of the tumor have to be destroyed to prevent recurrence. He advocated the following routine with the patient under general anesthesia: cuff excision is performed—that is, an incision is made through the mucous membrane around the external meatus; the mucous membrane of the urethra is then separated from the muscular layer for a sufficient distance beyond the tumor; a dorsal slit is made; a suture is placed in the dorsal region and the dissected mucosa is removed; the remaining urethral mucosal edge is sutured to the vaginal mucous membrane. Urethral catheterization is unnecessary. Deming reported complete relief by this method in 8 cases for periods ranging from 14 to 41 months.

Dodson advocated the foregoing procedure for the sessile type of caruncle.

Combination of conservative and radical methods. a. Simple excision plus caustic or cautery is one such combination. Kickham used a semicircular incision around the caruncle wide enough to include it and deep enough to include the full thickness of the mucous membrane. The caruncle is then excised and the base coagulated with a fine tip cautery. No sutures are necessary.

The Crenshaw method of treatment is carried out as follows (also described by Bumpus and associates):

1 The patient is placed in the lithotomy position and the parts are thoroughly cleansed with soap and water. A swab of cotton on a toothpick saturated in 10 per cent solution of cocaine and lubricated with a soluble lubricant is inserted into the urethra and left for 10 minutes.

2 The labia are separated by an assistant. On examination the caruncle is found to consist either of a single tag on the posterior wall or of posterior or lateral masses. Each tag is picked up with a small Graefe fixation forceps and clamped off in the long axis of the urethra with a special clamp which has a broad blade and a narrow crushing edge. Care is taken to include in the bite all of the caruncle and none of the submucosal structure of the urethra.

3 The growth is cut off close to the upper surface of the clamp; the crushing of the pedicle prevents all bleeding and makes an accurate removal possible. *The specimen is saved for microscopic study.*

4 The cut surface is thoroughly seared with acid nitrate of mercury solution applied with a wooden applicator. An excess of the acid to run over the blades of the clamp and cauterize other areas of the urethral mucosa is cautiously avoided.

Crenshaw reported that in 118 cases there were only four recurrences.

According to Fernier the Crenshaw method as described in the preceding paragraphs is very satisfactory for all but the broadly sessile type. As a modification of this method he advised that if the tumor is sessile it be held with more than one fixation forceps in order to draw it all into the clamp and further in order to avoid the uncertain control of the acid caustic that one use a small electrocautery such as is used by nose and throat surgeons, the cut edge being seared exactly as in the clamp and cautery operation for rectal hemorrhoids. He advocated the use of infiltration anesthesia.

Iverett advocated similar treatment but always warned the patient about the great tendency of urethral caruncles to recur.

b Excision and radium or roentgen therapy is another combination of conservative and radical treatment. Walther and Willoughby advised that at one use the radiocutting loop to

remove the caruncle and then follow up this procedure with radium or roentgen therapy.

#### HISTOPATHOLOGIC AND CLINICAL STUDY OF 120 CASES FROM THE MAYO CLINIC

One hundred and twenty cases of urethral caruncle were taken at random; those in which suitable gross specimens were available being given preference. Multiple sections were made from each specimen and stained with hematoxylin and eosin stain for microscopic study. The case records were studied; special attention being given to genitourinary symptoms and findings, treatment and revisits. Follow up letters were written to all patients requesting information as to their general health, symptoms referable to the genitourinary tract and further treatment for previous trouble with the urethra. The microscopic sections were studied and an attempt was made to correlate these findings with the clinical symptoms, rate of recurrence and age incidence.

The microscopic study included a thorough examination of the surface epithelium, the vascular reaction and the cellular structure. The surface epithelium was found to be of the stratified squamous type in the majority of cases. However, transitional epithelium was present in some. Ulceration of the epithelial covering was most evident in the cases of chronic caruncle and in those in which there had been previous treatment with caustics and so forth. Small islands of surface epithelium were found throughout the sections owing to the normal infolding of the urethral mucosa as described in the first part of this paper. The vascularity of the female urethra as described previously is abundant. The vascular reaction in these cases varied from simple dilatation to extravasation and actual thrombosis. This accounts for the red angry appearance of this lesion which is present in almost every patient. The uniformity of cell structure and lack of nuclear activity is evident (Figs. 1 through 4) and leaves little doubt as to the benign nature of urethral caruncles. The epithelial inclusions and urethral glands were studied closely and a few of the typical sections are included in this paper. The cell structure of the base of these lesions did not reveal the so-called roots or ramifications which have been described. In all





Fig. Regional prolapse showing squamous epithelium covering epithelial cell nests, dilated vessels, and lymphocytes (hematoxylin and eosin X55).



Fig. Photomicrograph of section of caruncle showing glandular element and epithelial nest (hematoxylin and eosin X40).

of the cases the initial change appeared to be a varying degree of prolapse of the urethral mucosa. This was regional in most instances but was circumferential in others.

Of the 120 cases studied 17 were asymptomatic. The microscopic picture in these cases was found to be the same as in the other 103 cases. The clinical picture was compared with the pathologic picture and no correlation was found. The cases with the most marked symptoms did not necessarily show the most marked pathologic changes. Only minimal changes were evident in some of the cases with severe symptoms.

The pedunculated appearance of some caruncles was explained on the basis of regional prolapse encouraged by the crypts and infoldings of the urethral mucosa. This appearance was further accentuated when irritation due to clothing pads and so forth took place leading to vascular congestion.

From the material studied for the preparation of this paper it is our impression that urethral caruncles are due to several factors. Among these are the anatomic structure of the female urethra which encourages regional as well as circumscribed prolapse; the anatomic location of the urethral meatus, resulting in almost constant exposure to trauma and irritation; and the histologic structure which encourages marked inflammation and congestion as well as increased sensitivity. For these reasons the caruncle may be symptomatic or

asymptomatic, be localized or circumscribed and occur in young as well as old people.

The symptoms of the urethral caruncle may vary from none at all to those of extreme severity. This wide variation cannot be explained on the basis of the gross or microscopic appearance. In this series of cases the signs or symptoms complained of most frequently were pain while sitting, walking during intercourse and so forth; smarting on urination; bleeding from the genital region; tumor mass in genital region; and frequency of urination. The patients complained of any one or all of these symptoms. Several of the patients had no symptoms, the caruncle being discovered on routine examination of the genital region. The size and location of the caruncle had no bearing on the severity of the symptoms. Their duration varied from 10 days to 17 years.

In our series the greatest number of urethral caruncles was encountered between the ages of 40 and 70 years. However, the age range extended from 6 to 88 years; the postmenopausal and multipara accounting for the majority. Of the premenopausal patients 65 per cent had children; of the postmenopausal patients 54 per cent had children. The age of the patient had nothing to do with the severity of the symptoms. As shown in the review of the literature, much emphasis has been placed on the age and marital history as etiologic factors. We believe that these are contributing factors and not basically etiologic.

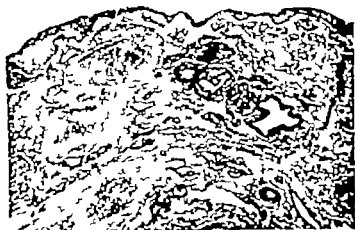


Fig. 3. Section of circumferential prolapse showing same findings as Figure 2 (hematoxylin and eosin  $\times 30$ )

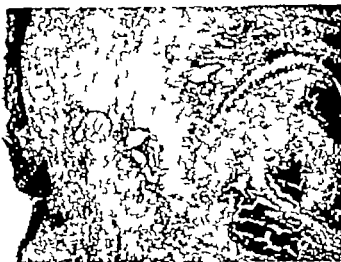


Fig. 4. Region of thrombosis in a caruncle (hematoxylin and eosin  $\times 70$ )

The different types as described in the literature were seen in this series but regardless of the classification used the basis is still the same—varying degrees of urethral prolapse and irritative reaction. By having so many different classifications one is complicating the picture and encouraging continued confusion. Urethral caruncle and urethral prolapse should be included under the same major heading—urethral prolapse. We are not advocating the discontinuance of use of the term ‘urethral caruncle’ for this term has a definite place in medical literature through its long usage. It could be applied to that group of urethral prolapses which is localized, whether sessile or pedunculated, in contradistinction to the circumscribed or circumferential type of prolapse.

It is evident that the most important differential diagnostic point is obtained by microscopic study of the pathologic specimens. This fact cannot be overemphasized for the ultimate diagnosis depends on this alone. One should not forget that the urethral caruncle and malignant lesions of the urethra can and do coexist.

**Treatment.** What is the correct treatment for urethral caruncle? This question cannot be answered in this paper and the current literature helps very little. The more one reads the more confused one becomes because there are so many methods and modifications offered. No one treatment is acceptable or applicable in all cases. The incidence of recurrence is high

if the patients are followed long and closely enough. Classic is Ferner's statement that few lesions of such distressing symptoms have been treated so unsurgically by surgeons.

In this series of 120 cases nearly two-thirds of the patients who answered follow up letters had recurrences of the caruncle regardless of the method used. The number of recurrences varied from 1 to 9. With this high rate of recurrence the patient should be warned that recurrence is extremely likely and that further treatment may be necessary. The main purpose of the treatment offered is symptomatic relief. This should be secured by the simplest and most suitable treatment depending on the nature of the lesion. The treatment should be carried out as an office procedure if possible. A specimen should be preserved for pathologic study. Stricture formation should be made unlikely by following treatment with periodic urethral dilatation and the treatment should be of such a nature that it can be repeated again and again if the lesion does recur without danger of complication.

The objection to the more radical procedures such as urethroplasty is that if they are not performed by a competent surgeon the urethra may be so shortened at the initial or subsequent operation as to result in urinary incontinence. This is encountered most commonly in the treatment of the circumferential type of prolapse where the urethra is actually shortened or the ureteral orifices pulled down into the urethra.

Most of the various methods of treatment were described in the first part of this paper. This was done because we feel that all of them may have a place in the treatment of urethral caruncle. No one type will successfully care for all of the various degrees of prolapse each may have its own place and indications. We feel that complete removal is advisable but do not believe that so much emphasis should be placed on destruction of the so-called roots of the caruncle.

### CONCLUSIONS

On the basis of a complete review of the literature and review of 120 cases, including follow up of patients and study of microscopic sections of pathologic specimens the following conclusions are drawn:

1 The anatomic and histologic structure of the female urethra encourages regional or circumscribed prolapse. The prolapse may be internal or external to the urethral meatus.

2 The varying degrees of trauma, irritation and so forth to which this prolapsed mucosa is subjected give rise to varied microscopic pictures.

3 Examination of cross sections through the urethral glands and mucosal infoldings has led to the misdiagnosis of neoplasm or precancerous lesion. Urethral caruncle is definitely a benign lesion but may coexist with carcinoma of the urethra.

4 The treatment offered is only palliative and rarely curative. The incidence of recurrence is high and further treatment is often required.

5 Regional or circumscribed urethral mucosal prolapse or both would be the only hypothesis which could explain the occurrence of urethral caruncle in all ages and the varied symptomatic pictures, ranging from no symptoms to most severe symptoms.

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NOVEMBER, 1948

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### A CRITIQUE OF THE McVAY OPERATION FOR INGUINAL HERNIA

THE continued search for improved methods for the repair of inguinal hernia is a laudable effort. New techniques should be critically investigated and if they appear to be logically conceived should be given adequate trial. Many innovations will fall by the wayside. A recent suggestion has been the reintroduction by McVay of the utilization of Cooper's ligament in inguinal herniorrhaphy. This method has been enthusiastically received in a number of clinics and excellent results are reported with it. However, there are certain fallacies apparent in the approach to this method which should receive mention.

On the basis of an excellent study of the inguinofemoral anatomy conducted in conjunction with Dr. Anson at Northwestern University, McVay<sup>1</sup> concluded that the 'funda-

mental error" in current methods of inguinal herniorrhaphy is the utilization of the inguinal ligament as the bastion to which the muscles and fascia of the abdominal wall are sutured. He correctly pointed out that, instead of being a fixed structure as is usually conceived, the inguinal ligament is mobile, being firmly anchored only at its two extremities. During the remainder of its course it is attached to the fascia lata of the thigh by only the thin investing fascia of the external oblique. He found further that the transversalis fascia instead of inserting into the inguinal ligament as is usually described is only loosely connected with that structure and actually inserts into the superior pubic (Cooper's) ligament. On the basis of these findings he expressed the conviction that the almost universal utilization of the inguinal ligament is a cardinal error in herniorrhaphy and his recommendation was that the Cooper's ligament be used in its stead.

There are several objections to this point of view. To consider this the fundamental error in inguinal herniorrhaphy would imply that operations fail because of lack of fixity of the structure to which the abdominal strata are sutured. Were this so, the recurrences thereby brought about would be due to the inguinal ligament being drawn upward, with resultant defect below it and recurrence in the femoral region. While this type of recurrence may occur, it is certainly very rare. As all descriptions of recurrent hernias testify, the overwhelming majority of recurrences take place above the inguinal ligament, at the site of the original defect. This being so, it is difficult to see how failure to utilize a firmer support could obviate these failures.

McVAY, C. B., and ANSON, B. J. Surg. Gyn. Obst., 1941, 74: 747-750.

It is certainly true that the transversalis fascia inserts into the superior pubic ligament and that its attachment to the inguinal ligament is merely one of contiguity through the agency of the thin investing fascia of the transversus abdominis muscle and aponeurosis. Nevertheless any suture placed in the inguinal ligament for the purpose of uniting the transversalis fascia to it must of necessity include the distal portions of the transversalis fascia namely those which extend from the inguinal to the superior pubic ligaments. Continuity of this aponeurotic layer is therefore restored by such sutures.

From a technical point of view there are further objections to the Cooper's ligament technique. The operation is technically more difficult than are those utilizing the inguinal ligament and the possibilities of injury to the femoral vein are vastly greater. While a surgeon of McVay's technical ability and extraordinary familiarity with the anatomical structures involved can unquestionably perform this operation with complete security the same cannot be said of surgeons generally who are charged with the repair of inguinal hernias. Those who have attempted to utilize the superior pubic ligament in the repair of inguinal or femoral hernias are aware of the greater difficulties of exposure. Drawings made from cadaver material in no way portray the problem experienced at the operating table by the bulging and protrusion of the preperitoneal fatty tissue which makes visualization of the superior pubic ramus extremely difficult. More important is the proximity of the femoral vein so that direct trauma and secondary thrombosis must be expected in a much larger incidence than occur with inguinal ligament herniorrhaphies.

The femoral vessels interpose another difficulty. While it is true that the medial portion of the inguinal canal can be closed by

suture of the transversalis fascia with or without internal oblique muscle to Cooper's ligament the lateral portion of the canal cannot be so obliterated because of the presence of femoral vessels crossing the superior pubic ramus. This is the portion of the canal involved in indirect hernias the most frequent of all hernial types. In order to close this portion of the canal Harkins<sup>2</sup> who has enthusiastically endorsed the McVay method sutures the lateral portion of his fascias to the inguinal ligament. This step-like procedure does not lend itself to accurate closure and the femoral vein itself forms part of the wall of the canal. McVay however uses a somewhat different method. He carefully elevates the inguinal ligament so that the suture line incorporates only the anterior layer of the femoral sheath.<sup>3</sup>

One further theoretical consideration suggests itself. Any operation which is predicated upon the need of a firm and unyielding bastion to resist the pull of muscular structures must be wrong in its conception. If the sutures themselves are strong enough to resist this muscular pull they will then cut through by the process of progressive ischemic necrosis of the tissues which are subjected to pressure against the suture material. As a fundamental requirement therefore in the surgical approach to any hernial repair the technique must be planned to avoid tension and pull. Otherwise the operation itself is faulty in its philosophy and no amount of strength of suture material or anchoring structure will compensate for what is a fundamental fallacy.

The criticisms detailed above do not in any way deny the correctness of McVay's anatomical observations, nor do they question the excellent results which have been obtained by the Cooper ligament technique. Furthermore

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689-700.  
McVAY, C. B. Personal communication.

the rationale of using the superior pubic ligament in the repair of femoral hernias is obvious. They do however, strongly doubt the assumption that lack of fixity of the inguinal ligament is the fundamental error in current operative techniques for inguinal hernia. And while results obtained may be as good as have been reported it remains to be shown that equally favorable results could not have been secured with the utilization of the more accessible inguinal ligament. Whatever improvement in results may be claimed for the method must be balanced against the added difficulties and hazards which the McVay technique entails. Approached from this point of view it appears scarcely credible that superior pubic ligament will replace the inguinal ligament in the routine repair of inguinal hernias.

LEO M. ZIMMERMAN

## THE DIAMOND JUBILEE OF PROFESSIONAL NURSING

LINDA RICHARDS America's first trained nurse graduated in 1873 the year in which the Nightingale system of nursing education was established in three schools of nursing associated with hospitals in New York, Boston, and New Haven. The figure of Linda Richards has become symbolic of professional nursing in America. Able and energetic, Miss Richards went to London soon after her graduation to confer with Miss Nightingale and to work in English and Scottish hospitals until she became familiar with the Nightingale principles of nursing education. Miss Richards established no less than ten schools of nursing during her lifetime nine in the United States and one under missionary auspices in Japan. Her versatility was further demonstrated by her interest in the care of the insane and in the promotion of visiting nursing services.

For two reasons the times were ripe for the development of nursing. First women were seeking new opportunities outside of the home. Second the use of anesthesia and the rise of bacteriological science were contributing to the rapid development of surgery. From that point on nursing and surgery went forward hand in hand with a resultant rapid increase in the number of American hospitals.

The main principles of the so-called Nightingale system of nursing education were

- 1 The nursing service of the hospital and the instruction of nursing students should be under the direction of a qualified nurse.

- 2 The school of nursing should have its own financial resources independent of the hospital which provided the clinical experience.

- 3 There should be a planned course of instruction making provision for both the preventive and curative aspects of nursing.

- 4 A suitable residence should be provided for the nursing students.

With one or two notable exceptions the early American schools were soon absorbed by the hospitals, lost their identity as schools and became administrative assets of the hospitals. As time went on it became evident that the demands on American nurses required a broader preparation than that acquired through an apprenticeship in a hospital. Three important studies of nursing and nursing education have been made during the past quarter of a century.

In 1922 the Goldmark study, financed by the Rockefeller Foundation, pointed out the necessity for more extensive preparation for public health nurses. By 1925 there were more than 2,500 schools of nursing in the United States, many of them operated by hospitals of questionable quality. Lack of standards in these schools led to the organization of the Grading Committee, on which the American College of Surgeons had mem-

bership. As a result of the nation-wide study made by this committee and aided fortuitously by the economic depression the number of nursing schools was reduced to about 1,500. Unfortunately the Grading Committee did not publish a list of schools indicating their rank or grade. Therefore neither the prospective student nor the public was able to determine the quality of any particular school. Many nurses earned diplomas from schools of nursing only to find after graduation that the quality of their education made them ineligible for various types of nursing work.

The third study recently published by the Russell Sage Foundation and popularly known

as the Brown Study was financed by the Carnegie Foundation and clearly points to the next stage in the evolution of American nursing.

One of the characteristics of American nursing has been its willingness to submit to critical self-analysis. The Diamond Jubilee of Professional Nursing gives us an opportunity to acquaint the public with the achievements of the nursing profession in America, and more importantly it enables us to secure the interest and understanding of allied professions and the general public in the further adaptation of nursing service to the present and future needs of the American people.

PEARL McIVER







The National Portrait Gallery

SIR CHRISTOPHER WREN F.R.S.

After the portrait by Sir Godfrey Kneller, painted in 1711.

# THE SURGEON'S LIBRARY

## THE BOOK SHELF

DOCTOR THOMAS WILLIS AND SIR CHRISTOPHER WREN  
BARRY J. ANSON, Ph.D. (Med. Sci.) Chicago, Illinois

IN the entire course of the history of medicine there is no more illustrious association of author and artist than that represented by the collaborative effort of Willis and Wren in the preparation of *Cerebri Anatome Nervorumque Descriptio et Usus* (1664).<sup>1</sup> Each eminent in his profession brought to this conjoint endeavor an ability exceeding that of contemporary writers and craftsmen. While their contributions to the treatise might have seemed at the time equal in value to a present day appraisal of worth would, in respect to accuracy, tip the balance in favor of Sir Christopher. His delineations of neural morphology are so faithful to the dissected subjects that they might be of laboratory service today; the interpretive text by Doctor Willis (Fig. 1) on the contrary is a repository for an outmoded concept of bodily activity. The illustrator's path was straightforward; he prepared pictorial records of observed anatomic features. The author's approach to his task was, of necessity, oblique; his thinking was deflected from a straight course among morphological landmarks, by potent doctrinal winds of Graeco-Roman origin. He must translate mystery as he undertook to explicate the uses of the brain. To Doctor Willis this seemed as difficult a task as to paint the soul, of which it is commonly said that it understands all things but its self. To the nature of their diverse accomplishments we shall return after having reviewed certain important biographical facts.

Thomas Willis began his study of medicine at Oxford in 1642. In that year besieged by the armies of Parliament King Charles retired to Oxford, which he proceeded to fortify. Willis, faithful to the King, was a member of the defending

garrison. Among the notable men in Oxford at the time, was William Harvey, the King's favorite physician. Thomas Willis graduated a Bachelor of Medicine in December 1646. In the same year Harvey left the service of the King and returned to London. Thomas Willis remained in Oxford as a practitioner of medicine. With the restoration of Charles II in 1660 Willis' loyalty was rewarded; he was made Sedes Professor of Natural Philosophy.<sup>2</sup>

In 1645 before the civil war had reached its conclusion a group of scholarly Londoners organized themselves into a society for inquiry into natural philosophy. By their removal to Oxford in 1648 the society became divided; however they were united and chartered in 1662 by the King as the Royal Society of London. Thomas Willis was elected a Fellow of the Society in 1663.

In his scientific endeavors, Thomas Willis was beholden to Richard Lower and Christopher Wren, and he acknowledges the bond of gratitude in his preface to *The Anatomy of the Brain* for the more accurate performing of this work, Willis writes: "I made use of the labours of the most learned physician and highly skillful anatomist, Dr. Richard Lower for my help and companionship on the edge of whose knife and wit I willingly acknowledge to have been an help for the better searching out both the frame and offices of before hidden bodies. To Christopher Wren, Willis expresses his indebtedness for the delineation of the many figures of the brain and skull (Figs. 2a to 2d).

Richard Lower was a physician of London and author of a treatise on the anatomy of the heart *Tractatus de Corde* published in 1669. Lower knew that the movement of the blood depended upon that of the heart; he described minutely the whorly course of the cardiac fibers, and their of

Contribution No. 400 from the Department of Anatomy, Northwestern University Medical School.  
<sup>1</sup>Thomas Willis' original account was published in 1664. Later it appeared as part of a volume of eleven treatises. The combined work is the *Prælectiones Anatomicae* published in London in 1684. The treatise on the brain (Number VI of the series) is hereinafter mentioned as a source of quoted measures and of figures. It is the fourth in the *Prælectiones* published in London in 1684.

<sup>2</sup>Notes from Thomas Willis by William Snow Miller. *Bulletin of the Society of Medical History of Chicago* vol. 3, no. 2, Oct. 1923, pp. 215-232.

fice in contraction of the muscular walls he recognized the correlation between ventricular thickness and muscular effort in systolic contraction, he described and figured the venous valves, and accounted for their function. Lower not only elaborated clearly and serviceably upon Harvey's concept of the circulation, but stated that "what ever statements writers before Harvey made about the movement of the blood through the ventricles of the heart are so empty and worthless that they have already spontaneously disappeared into oblivion." As will be seen however it was Richard Lower's teacher and friend, Thomas Willis, who managed to pluck the outworn notion from oblivious fate.

In his early years Christopher Wren (frontispiece) occupied himself chiefly with astronomical and mathematical studies, and with invention. Following the outbreak of the Great Plague, in 1665 he left London, for a visit to Paris.<sup>3</sup> At the end of 6 months, in February of the year 1666 he was summoned back to England, to report on the repair of Old St. Paul's. While so engaged he regularly attended the meetings of the Royal Society then mainly engaged in considering how a return of the pest could be averted. In September of the same year came the Great Fire and the City of London was destroyed. With energetic alertness, Wren submitted to the King his design for the rebuilding of the City. In response, his monarch appointed Wren the Surveyor-General a post which he held for almost half a century. In this capacity he became architect for repairing the whole City: the Cathedral Church of St. Paul's, all the parochial churches with other public structures. Certain of these assignments were of monumental proportions—the rebuilding of the dome of St. Paul's Cathedral occupying at least part of his attention for forty years. Additionally he is credited with the rebuilding of some fifty-two London churches (Fig. 3).

Christopher Wren's early education was mainly scientific. Not only was he a regular attendant at meetings of the Royal Society but also one of its founders and later its President (in 1680). He was a member of Parliament, a shareholder in the Hudson Bay Company during the period of England's territorial expansion, and a public-spirited Londoner who was consulted on all matters connected with the City—unrelentingly assiduous, to his death at ninety-one years of age.

Before Christopher Wren became an architect he was already a scientist of European fame, a

compeer of Harvey and Newton. His genius was displayed not only in the fields of mathematics, astronomy and invention, but also in some departments of medicine. He came to occupy the chair of Astronomy at Gresham College in London at the age of twenty-five; three years later he was appointed Savill Professor at Oxford. With the genius of a Leonardo he invented, or proposed plans for a weather-clock, an artificial eye with humoral content, an instrument for writing double new ways of engraving and etching and methods of submarine navigation. He introduced liquids into the blood stream of animals, forecasting similar experimental practice in transfusion and in hypodermic injection. In the field of physiological experimentation there is, curiously, no reconciliation between his own observations and the physiological notions held by Willis—as there is none between theirs and the concepts of Harvey and Lower. Despite the fact that they were colleagues and fellow members of the Royal Society their anatomic views seem insulated possessions—individually held, and never reconcilable contributions to an accumulated store.

Sir Christopher Wren's figures of the brain (Figs. 2a to 2d) take their place in a large gallery of neurological illustrations (Figs. 4a to 4f, 5a to 5f).<sup>4</sup> Predecessor pre-Vesalian, figures are those of Albertus Magnus, Johannes Peyligk, Gregor Reisch, Wendelin Hock, and Johann Dryander; those encountered in the magnificent *Fabrica* of Vesalius, and in the contemporary volumes by Charles Estienne, Constantio Varolio and Bartolomeo Eustachi in the later treatises by Caspar Bartholin, Johann Vesling, Raymond de Vieussens, Godfried Bidloo and Giovanni Domenico Santorini—and all these antecedent to the first editions of textbooks of gross anatomy and neuroanatomy. Wren's drawings are less delicate than those of Santorini, less forceful than the neurological figures in the Vesalian *Fabrica*; they are far more attractive than the contemporary illustrations in the *Synopsis* of Vesling, in the *Anatographia* of Vieussens, and in the *Institutiones* of Bartholin; they are more analytical, though far less statuesque, than the comparable figures in the folio volume of Bidloo.

In order to appreciate fully the degree to which Willis' system is dependent upon the primitive

<sup>3</sup>In these two plates of illustrations all but figures 2a to 2c and 5a were photographed from the original volumes. In the Archibald Church Library of Northwestern University Medical School.

<sup>4</sup>Figures 2a and 4f were copied from the *Opera Omnia Anatomica* of Christiaan de Boerhaave and Albinus, which is the 1753 revision of Andreas Vesalius' *De Humani Corporis Fabrica Libri Septem*. In the edition of 1753 the figures were reproduced from copper engravings. It will be remembered that the three editions (1543, 1575, 1687) of the *Fabrica* published during the life of Vesalius contain wood-cuts, again used in the German edition (1783) by Leveillé.

<sup>3</sup>Biographical notes from *Sir Christopher Wren, Bicentenary Memorial Volume* published under the auspices of the Royal Institute of British Architects. Hodder and Stoughton, London, 1923.

writings in the medical sciences, it is necessary to examine more than his accounts of the heart and of the brain. The essential elements are continued in the *Practice of Physick* published in 1684 (Fig 6). Herein the reader is presented with an inclusive picture of medical concepts which are negligibly influenced by William Harvey's account of the nature and the circular movement of the blood. More than a half century after the publication of Harvey's treatise, and fifteen years after the appearance of Richard Lower's tract on the heart, Willis' concept of nervous physiology was still based upon the Galenic notion of vapors and distillates—a system which then was fifteen hundred years old.

Thomas Willis, eschewing the knowledge recorded in the works of Harvey and Lower clings to the ancient doctrine of the spiritus or pneuma perpetuating the traditional belief that the body of man is an anthropomorphous sponge designed to house a leavening breath of celestial origin. Air with its burden of spiritus, was thought to be inhaled and vented through the trachea and the innumerable cutaneous pores the latter openings being described as if they were the peripheral ostia of the blood vessels. Alimentary fuel for the bodily fire was carried by the portal vein to the liver in the liver this nutrient chyle transformed into the natural spirit whose function it was to control nutrition, growth and reproduction. The heart drew this nutritive mixture from the hepatic pulp to its own right chamber wherefrom it was wafted through the interventricular wall—supposedly porous—to attain the left ventricular chamber. Mixed with the inhaled breath, the natural spirit was converted into the vital. The greater part of this vaporous compound was believed to be carried away by the arteries to serve as the source of life and the bodily heat. However a small part of this life-giving spirit was admitted to the complex arterial network at the base of the brain. In this miraculous plexus, termed the *rete mirabile* the spiritus was rendered fit to perform the animal functions, that is, to impart sense and to cause motion. In this thrice refined form the spiritus lingered within the brain as the substance of opinion and judgment and the stuff of the human soul.

Doctor Thomas Willis modernized this early philosophic doctrine by bringing to the Galenic notion of pneumatic elaboration that of fermentive inkindling. Willis believed that fermentation is not limited to the formation of yeast, to the souring of vinegar and to other ordinary zymic processes, but that it is an all pervasive chemical phenomenon which accounts as well for the nor-



Fig 7. Portrait of Thomas Willis, Sidley Professor of Natural Philosophy at Oxford.

mal heating of the human blood and for its uncontrolled intensity in fevers. Willis believed that the process of distillation was as essential in bodily metabolism as it was fundamental to the preparation of healing pharmaceuticals. Distillation served as a means of separating volatile materials from substance of more fixed character. In simple form the apparatus consisted of a gourd-shaped cucurbitae a shrouding alembic cemented to the former a stove and a receiver (Fig 7). The substances were macerated and digested in the heated cucurbitae the vapors, condensed in the alembic, were carried away through the beak of the alembic to the receiver.<sup>6</sup> As will be seen Willis found the counterparts of these distillatory pieces in the human thorax and head. To him, the calvarium together with the subjacent meninges and brain was a kind of alembic, the heart

<sup>6</sup>Comments from *Pictoria History of Ancient Pharmacy with Sketches of Early Medical Practice*, by Hermann Peters, transl. Wm. Netter G. P. Englehard, Chicago, 1839.

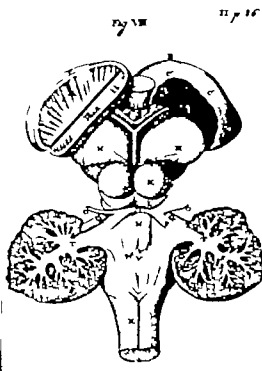
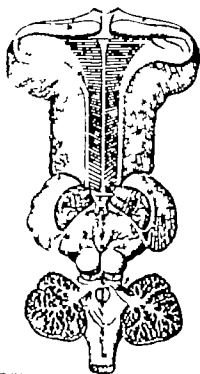
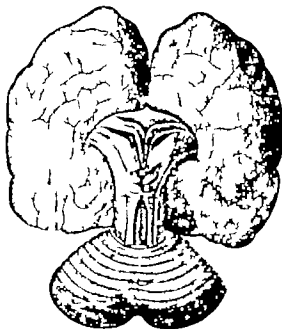
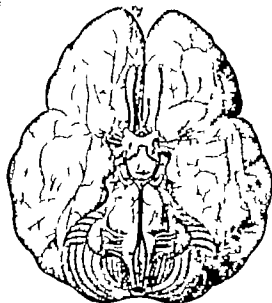


Fig. 2. Figures II, III, VII and VIII from *The Anatomy of the Brain in the Practice of Physics* by Thomas Willis (1654). a, "The basis of a sheep brain taken out of the skull, and the roots of the vessels cut off, where all the arteries, by ink being injected into one of the carotides, are

made black and more conspicuous. b, Showing "the out most or superior superficies of the humane brain taken out of the skull where the border of the brain being loosened from the knitting of the other parts, made by the membranes, is elevated and turned outward, that the sinuses of

(Legend continued on opposite page)



Fig. 3 Sir Christopher Wren's principal buildings in London and elsewhere. Drawing by C. R. Cockerell, R.A. engraved by Wm. Richardson. From *Sir Christopher Wren*

Bicentenary Memorial Volume published under the auspices of the Royal Institute of British Architects, Hodder and Stoughton, London, 1923

and its great vessels behaved as the cucurbit and the distilling stove (Fig. 8)

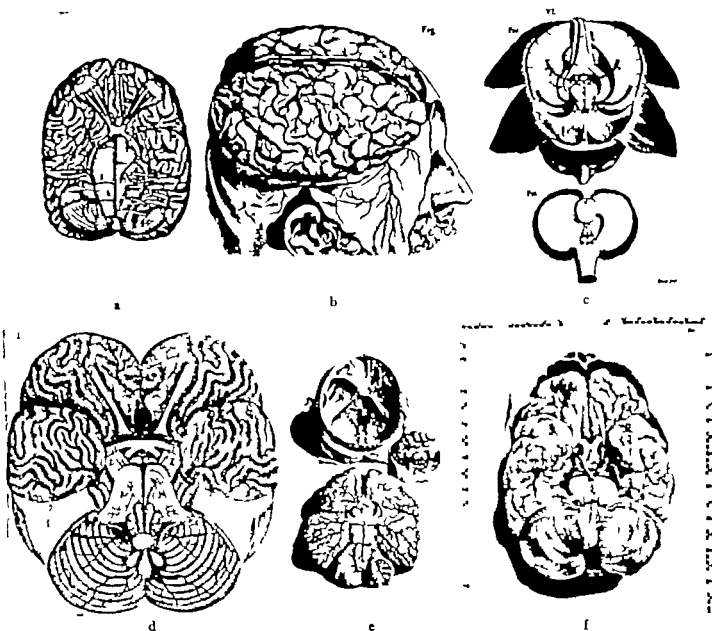
Although he retained the ancient distillery as part of the physiological machinery, Willis, influenced by the then new chemistry, could no longer regard the spiritus as a self-sufficient vapor intermediate between body and soul; he must think of it in association with sulphur, niter and salt. In his system, heavenly spirit became an alloy through fermentive interaction with mundane elements. Regarding the spiritous part of the compound, Willis writes that its constituents are highly subtle, Aethereal Particles of a more Divine Breathing, which our Parent Nature hath hid in this Sublunary World, as it were the Instruments of Life and Soul, of Motion and Sense.

Being volatile, they are always endeavouring to fly away; consequently lest they should too soon leave their subjects, they are bound sometimes with more thick Particles. Through the process of fermentation, operative within the chambers of the heart and its major vessels, the particles of the four elements, freshly ebullient, like Water boiling over a Fire, the blood is propelled through the vascular channels, not without great Tumult and Turgescency. The degree of admixture makes a chemical hierarchy with the motionless minerals of fixed nature at one end of the scale, and living creatures at the other—the animate things being rich in spirit, as would be requisite for sense and motion.

Willis would extend this concept to account for the final elaboration of animal spirit in the brain. This is the textual and pictorial burden of the *Cerebri Anatome*. Doctor Willis ventures the guess that the Brain with Scull over it, and the appending Nerves, represent the Little Head or Glassie Alembic a Sponge laid upon it, as we use to do for the highly rectifying of the Spirit of Wine. The blood rarefied by the cardiac heat, is carried from 'the Chimney of the Heart' to the

the oblong marrow, the fornix or arched vault, and other processes, may be clearly and distinctly beheld." c. "The brain of a sheep bent back and cut a little open in the places where they stick together near the streaked bodies, that its interior substance may be turned the inside out and unfolded on a plain." d. Represents the oblong marrow taken out of the head of a sheep with the brain cut off and removed, and with the cerebellum and one streaked body cut in two in the middle, and other things chiefly belonging to the medullary trunk."





Figs. 52 to 56. Illustrations of the anatomy of the brain continued. a. Constantino Varolio *De Verris Oculis* 1573. b. Caspar Bartholin *Institutiones Anatomicae* 1641. c. Johann Vesling *Synagoga Anatomica* 1647. d. Ray

mond de Vieussens *Neurographia Universalis* 1685. e. Godfried Bidloo *Anatomia Humani Corporis* 1685. f. Giovanni Domenico Santorini *Septem Decim Tabulae* 1775.

more fit for the performing the offices of motion and sense to this end the substance of the Brain is exceeding full of a Volatile Salt which is of great Virtue for the sharpening and subtilising the spirits.

In the treatise entitled *Of the Accension of the Blood* Thomas Willis discusses particularly the growing hot or inkindling of the Blood (Fig 6) In order that a flame may be inkindled in the heart and continue to burn there is need of a free and undiscontinued access of Air to this end the action of the lungs serves to carry away the vaporous Effluvia, threatening the suffocation of the flame and to supply nitrous food neces-

sarily requisite for the burning Like a flame the life of the blood may require additional ventilation to which end besides the greater breathing places of the Breast innumerable lesser viz the Pores of the skin gaping everywhere through the whole Body do send forth Effluvia departing plentifully from the boiling blood If alimentary fuel for the cardiac fire be denied the vigor of the blood is diminished and when the nutriment becomes too thin and watery the fervour of the blood like flame without food uses to be remitted

Recognizing that the flame inkindled in the blood appears not at all, Willis records his belief that it is most thin and burns in the Heart



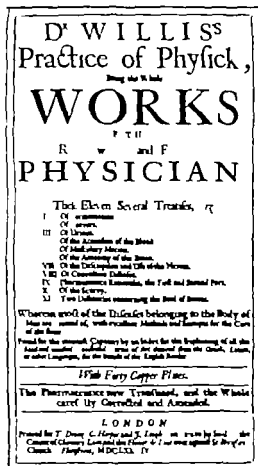


Fig. 6. The page of Thomas Willis *Practice of Physick* (634)

and its depending Vessels as it were shut up in Receptacles it does not blaze clearly but perhaps remains in the form of smoke or a vapour or breath even should the blood "openly flame out yet it might be so done that its shining being most thin, may not be perceived by our sight, as in the clear light of the day we cannot behold a glowing red-hot iron, nor shining sparks, nor false fires, nor rotten wood nor many things shining by night."

Willis finds support for his opinion in the fact that some "hot living Creatures" send forth certain fire or vaporous blood, when they have put off their inner garments, "night going to bed some fire or Candle." Similarly, it is noticed "in burning Fen-ber caused by moderate drinking of Wine or strong Waters, that the blood, as the flame of it is very much increased, doth grow exceedingly hot, even to the degree that some believe they have seen the 'burning fire and flame in the eyes'; these observations argue 'that the blood is very strong, and shew that it penetrates the inclosure of the Brain.' Willis himself knew certain ingenious Men of very hot brain, who affirmed that after very plentiful drinking of Wine, he was able in the darkest night to read clearly."

In accounting for the further movement of the heated spiritus, the arteries, veins, venous sinuses of the dura cerebral ventricles, cerebrum, cerebellum and medulla oblongata are all brought logically but erroneously into the traditional physiological scheme each gross anatomical part is employed as if it were a living sieve retort or pipe in a neurological distillery. When it is received from the heart the spiritus finds its loftiest residence in the brain. In this final anatomical station it is fully elaborated, preparatory to carriage by spinal and peripheral portions of the nervous system to the muscles and to the organs of sense.

The large vessels, carotid and vertebral are the major conduits from the heart to the brain either pair of these inclining one towards the other are mutually conjoined. Correspondingly the meninges are stuffed throughout with veins, sent from four bosoms" (the dural sinuses of our description) which ultimately receive the blood from the anastomosis of arteries now termed the *circulus arteriosus Willisii* (Fig. 2a). The veins like promptuaries or store houses framed in several places, are destined to receive the blood "returning from every region and corner of the brain and at length transfer their burden into the jugular veins."

The globous brain is aptly described as being marked externally by chinks, "turning and winding like to the rollings about of the intestines." Upon removal of the cerebral hemispheres there is exposed an internal substance which throughout its extent is "chamfered or streaked." In Willis' opinion these markings "were made by nature, as it were passages or channels for the passage and return or going to or from of the spirits out of the callous body into the oblong marrow and on the contrary (Fig. 2b) That is to say cerebral substance is physiologically important in so far as it is a spongy or a foraminous mass fit to transmit the nervous spirits.

The cerebral mechanism is protected by the bony skull internal to which the hard outer meninx (*dura mater*) serves to restrain and keep within the brain the effluvia of the animal spirits, lest they should too thickly evaporate and thus be dissipated to the great detriment of the body. This heavy meninx is important also in containing capacious cavities ("bosoms" in Willis' terminology) which "like promptuaries or store houses framed in several places, receive the blood returning from every portion of the brain finally transferring their contents to the jugular veins. These sinus-like enlargements are, however more than storage depots they too are auxiliary refineries, since while the blood remains



Fig. 7 Ancient distillation. From *Pictorial History of Ancient Pharmacy* by Hermann Peters, translation by Wm. Netter Chicago G. P. Engelhard Co. 1889

collected within them, it seems to be the source of heat, requisite for the distilling forth of the animal spirits as if it were a certain chymical reaction. These bosoms, then, are like a certain distillatory bath so the other membrane of the dura mater being stretched out about the whole head is like an impervious alembick, which with its covering keeps within the spirituous breaths that they not be immoderately evaporated. In this way by admirable contrivance, heat is engendered in the localized furnaces, and is conserved by dural and osseous insulation.

The interior soft meninx, far thinner than the exterior is covered over throughout with the infoldings of arteries and veins and so waters all the spaces of the brain and cerebel with unnumerable rivers. Then these arteries and veins meet in anastomoses, in order that the blood to be earned from the heart into divers regions of the brain might be exactly mingled as to its parts and particles, before it come to the place designed. They are multiple in order that 'if by chance one or two should be stoppt, there might easily be found another passage instead of them.'

Thus it is that the meningeal and cerebral vessels which carry the vapors through the whole compass of the head are like distillatory organs. The latter in the process of cephalic circulation

separate the purer and more active particles from the rest, subtilize them and finally insinuate the spiritualized elements into the substance of the brain. The spirituous distillate regardless of what its destination may be, must first be absorbed in this fashion by the brain tissue to that end its whole exterior superficies is made uneven and broken with turnings and windings and rollings about almost like those of the intestines, thus, with a complex pattern of gyri and sulci, it is framed both for the more plentiful reception of the spirituous aliment, and also for the more commodious dispensation of the animal spirits. This nutrient spirit is not only drunk in everywhere in the plain superficies but also through the walls of the sulci the folds being so disposed in order that the spaces for the receiving the juyce might be enlarged.

These animal spirits, derived from the spirituous liquor are carried into the callous body, as into a spacious field. The corpus callosum (Fig 2c, at K) according to Willis, is the headquarters of the animal faculties, there residing as in a publick emporium or mart from this repository as occasion serves, they are raised up and drawn forth for the uses of every faculty. While at relative leisure, they gently circulate through the corpus callosum and spread to the fornix. In

musings or reveries, the streaked pathways of the fornix are their sheltered lanes along these are engendered our sorrows and sighs, our joys and smiles.

At regular intervals the cerebral tissue becomes surfeited with its spirituous content flowing inwardly it stuffs all the pores and passages of the brain, and so excludes for that time the spirits from wonted tracts and orbs of expansion whereupon sleep, or an eclipse of the animal spirits happens. Conversely waking returns, when from the liquor unstill'd, the more subtil part is exalted into very pure spirits, and at length the more watry being partly resolved into vapours, is exhaled, and partly supped up by the passages entering the substance of the brain.

This discussion of storage introduces the matter of the cerebral ventricles, for which a use is found in the traditional manner.

The presence of the ventricular spaces had brought pacific pleasure to the philosophers of the early Church. Albert Magnus, the learned Dominican depicted them in stylized fashion (Fig. 4b) they offered a sheltered nidus for the soul a place for ultimate refinement of a spirit whose source was celestial. By Gregor Reisch Professor of Emperor Maximilian I they were compartmentalized to care for the activities of imagination, cogitation, fantasy, memory and the kindred forms of cerebration. In Peyligk's medieval compendium for lay scholars, the ventricles took the traditional form (Fig. 4a) to subservise the familiar philosophic function. And although the anatomy of the scalp and cranium was pictured with structural correctness by Dryander the ventricles were superimposed upon the calvarium in stereotyped treatment (Fig. 4c). Willis must fit these cavities into his schema since there is nothing met with in Nature that is not destined to some use. But he modifies the inherited system to meet his needs. In Willis' opinion the serous latex which is the vehicle of the spirits, and is introduced together with them into the pores of the brain "after it is grown stale and being attenuated into vapour doth distill forth into this cavern and there at last grows into a watry humor. The humor having served its purpose as a vehicle is then removed by the veins—as if it were a condensation falling into the cucurbitile.

The discussion then passes from the brain to the "spinal marrow." In form it is forked, as it were like the poets Parnassus, like the letter Y (Fig. 4d). Because of the relative directness of its course from head to tail and because of the simplicity of its structure the oblong marrow seems to be a broad or high road into which all the ani-

mal spirits perpetually flow from their double fountain to wit the brain and cerebel, to be derived from thence into all the nervous parts of the whole body. From the cephalic stations the animal spirits are directed either outward towards the nerves, when they exert the locomotive faculty or they look inward towards their fountains, when the acts of sense, or rather the apprehensions of sensible things are performed. Within the oblong marrow "a more large and greatly open path leads straight to the spinal marrow through which the spirits flow forth to the nerves, the executors of spontaneous motion in most members.

The cerebellum possesses a characteristic morphology and is designed "for some works and wholly distinct from the brain." While within the brain imagination, memory discourse, and other more superior acts of the animal function are performed, it is the office of the cerebellum to supply the animal spirits to those nerves by which the involuntary actions (such as cardiac action, respiration, and digestion) are carried out after a constant manner unknown to us, or whether we will or no. And while we may be aware of the movement of spirits in the cerebrum, those which inhabit the cerebellum "perform unperceivedly and silently their works of nature without our knowledge or care." The difference in spirituous behavior is a consequence of observable structural characters (Fig. 4b) for whilst the brain is furnished as it were with uncertain meanders and cranking turnings and windings about, the cerebellum "is furnished with folds and lappets disposed in an orderly series." Within the cerebellum then "the animal spirits are expanded according to the rule and method naturally impressed on them as it were in a certain artificial machine or clock, not as the same spirits are regimented in the cerebrum where they are continually driven into fluctuations as it were with the winds of passions and cogitations." From the cerebellum the oblong marrow is continued into the utmost recesses of the whole spine or backbone. This medullary prolongation, the spinal marrow "is as it were the common passage or channel of the spirits flowing out of the head into the nerves." They follow the nervous pathways to the muscles, return by them from the organs of sense. The swellings at the brachial and the lumbosacral levels resemble according to Willis, the widenings which occur in a channel where rivulets are received.

Thus Thomas Willis succeeded in utilizing all the gross anatomical eminences, gyrate ridges, arches, vessels and investments found within the cranial cavity in this investigation he was un-

aided by experimentation or staining procedure.<sup>7</sup> Willis anatomical studies carried him far in the field of gross morphology he presented the four fold arterial supply and dural venous reservoirs in the detailed manner now made familiar to all students by our modern encyclopedic textbooks the chief macroscopic features of the cerebrum cerebellum, medulla oblongata and spinal cord were accounted for in his treatise. However in zealously attempting to discover a use for each dilated vascular channel laminated prominence, ventricular space, foramen and medullary rootlet he was drawn into fallacious physiologic interpretations. Thomas Willis progressed as far in the field of functional interpretation as the ancient, and astonishingly persistent, system of physiology would allow. Thinking only in terms of the transmission or of the temporary warehousing of the spiritus Doctor Willis sought in each discrete anatomic structure a suitable headquarters for a vaporous distillate. *Distillation gave evidence of the existence of minute tubules, not of the presence of nerve fibers nuclear bulging indicated a massing of spongy substance not the grouping of cell bodies.* Influenced profoundly by the inherited medical beliefs of his own and of past centuries Willis assigned a chemical function to the heated blood the meningeal vessels the dural shroud, and the cranial vault. They represented parts of a human balneum Mariae Willis reasoning that whatever refining process was serviceable in the preparation of a medicine must be infinitely more important in the purification of a vapor which is destined to become the soul of man did not hesitate to put into the cranial cavity the neural counterparts of an apothecary's paraphernalia. The *Cerebre Anatome* therefore bridges the gap between the sixteenth century Vesalian neuroanatomy and that of our own day with interpretative resourcefulness and ingenious logic it fits new anatomic pieces into a predetermined physiologic pattern.

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A correct interpretation of cerebral and cerebellar function must wait, of course, on clear demonstration of the tract, even the pioneers of modern neurology presented their discoveries as late as the nineteenth century. In the sixty years between 1810 and 1870, Bp, Rudolph, Goll Gowers, Clarke and Flechsig described the tracts, fascicles or columns which bear their names.

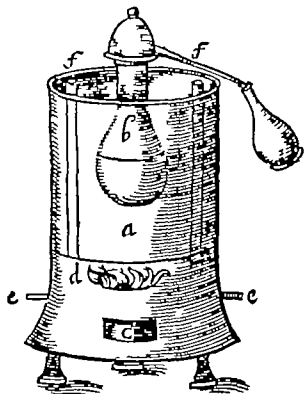


Fig. 8 Distillation in Balneum Mariae. a, Copper vessel full of water. b, Gourd-shaped flask, or cucurbit, containing the material to be distilled. c, Door through which a lamp is placed then closed. d, Oil lamp, with three or four wicks, beneath the vessel. e, Openings through which air enters. f, Two pipes, passing through the water by which fumes escape. Figure taken from *Antididarium Generale* by Johann Jacob Wecker. Baudl 1506 the legend is a translation of Wecker's Latin description.

and enchanneled movement of the same eminences were manufactories or places for collection of excrementitious wastes—of drugs removed to sanitize the vital fuel nerves were pervious branches of a medullary tree—whose porosities were arborescent continuations of larger spaces at the core of the brain.

Similarly Thomas Willis explication of cardiovascular action is fundamentally Galenic his notion of arterial content is rooted in Empedoclean and Aristotelian philosophy. Willis adds the chymical phenomenon of admixture. While the spirits are the ethereal particles of a divine breathing sulphur salt and nitre are of earthly derivation. In the animal body the several kinds of particles, by fermentation break apart the rarefied part like Water boiling over a Fire is carried through the vessels with great tumult and turgency moved by the vital ferment in the

Chimney of the Heart. In Willis schema, as in that of the ancient writers, the heart is the important workshop of the blood. Willis adds to the older concepts a description of a mechanism for heating the blood. He believes that it is accom-

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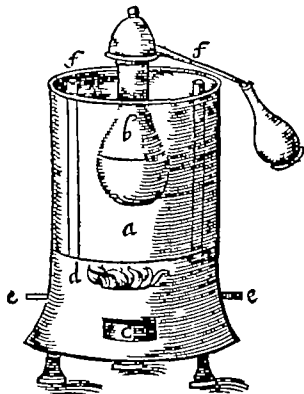


Fig. 8. Distillation in Balneum Mariae. a Copper vessel full of water b Gourd-shaped flask, or cucurbit, containing the material to be distilled, c, Door through which a lamp is placed, then closed d, Oil lamp, with three or four wicks, beneath the vessel e, Openings through which air enters f Two pipes, passing through the water by which fumes escape. Figure taken from *Antididactum Generale*, by Johann Jacob Wecker Basil, 1636 the legend is a translation of Wecker's Latin description

and enchanneled movement of the same emissions were manufactories or places for collection of excrementitious wastes—of drugs removed to sanitize the vital fuel nerves were pervious branches of a medullary tree—whose porosities were arborescent continuations of larger spaces at the core of the brain.

Similarly Thomas Willis' explication of cardiovascular action is fundamentally Galenic: his notion of arterial content is rooted in Empedoclean and Aristotelian philosophy. Willis adds the chymical phenomenon of admixture. While the spirits are the ethereal particles of a divine breathing sulphur salt and nitre are of earthly derivation. In the animal body the several kinds of particles, by fermentation break apart the rarefied part, like Water boiling over a Fire is carried through the vessels with great tumult and turgency moved by the vital ferment in the Chimney of the Heart. In Willis' schema as in that of the ancient writers, the heart is the important workshop of the blood. Willis adds to the older concepts a description of a mechanism for heating the blood. He believes that it is accom-



## REVIEWS OF NEW BOOKS

THE author of the book entitled *Histopathologic Technique*<sup>1</sup> had certain very definite purposes in mind. It was written to give a systematic treatment of recent advances in this field without attempting to be encyclopedic in scope. Many methods that have been included in previous works on this subject have been excluded either because they are obsolete or impractical or because they have been replaced by better methods. He has endeavored to find methods that depend for constancy of results on controllable factors such as time, temperature, hydrogen ion concentration, and concentration of reagents rather than upon the skill of the technician. Most of the methods described are applicable to tissues fixed routinely in formalin rather than in special fixatives. The author has himself made many modifications and improvements of older methods.

The volume is divided into 21 chapters. The first 11 chapters deal with the use of the microscope, the equipment essential to histopathologic technique and the general principles of fixation, decalcification, sectioning and staining. These are followed by 10 chapters dealing with the staining of specific parts of tissues such as nuclei, cytoplasm, enzymes, pigments, cell product (glycogen, mucin, etc.), fats and lipid connective tissue parasites and tissue of the nervous system. Chapter 20 describes methods of dealing with hard tissues such as teeth and bone. Chapter 21 describes various special procedures such as vascular injection, corrosion autography and microencapsulation. The final chapter deals with buffers with a description of the principles involved and 5 pages of tables for the making of various buffer solutions.

Of particular importance is the chapter dealing with the formation of enzymes in tissue. Methods are described for alkaline and acid phosphatases, lipases, lactates and dephosphatase. These are among the more recent significant advances in histochemical technique.

Directions for staining are clear and arranged in a very systematic order. The results of special stains are illustrated, and the stained tissue may be readily identified. Of particular interest is the manner of coloring the higher up staining method for special purposes. The staining of paraffin sections for fluorescence in fast green is a new staining sectioning stain. The fast green, etc. of eight different methods of staining in (Weigert's) fast green are given. The staining of the central nervous system is also given. The staining of the central nervous system is also given. The staining of the central nervous system is also given.

References are given for all the methods described and their modifications. The entire volume is well written and anyone who is interested in histologic technique will find it extremely useful.

Opal E. Hutter

IN the strict sense of the word *The Long Walk*<sup>3</sup> by Betsy Barton is not a novel. No central character nor theme of events nor climactic adventure form the axis of the story. Rather it is a depiction of the routine events and experiences on a ward for men with injuries of the spinal cord in a Veterans' Administration hospital. The passage of a few hours in her story has been sufficient for the author to lay bare with a restrained hand the personal tragedies, frustrations, unfulfilled dreams, and warped philosophies which may be a part of doctors and patients alike.

The story has to do with the mastery of individual fears and conflicts which leads to a happier personal life and a life more useful to others. Woody helped his ward mates by example but his own cares were resolved only in death. Arthur, the hospital psychologist, was unable to succeed in his own work until he had found the means and strength to heal himself. Henni, unbothered by the usual mental fetters of the paraplegic patient, became truly rehabilitated. Janet, through whom the author speaks autobiographically and therefore knowingly, expresses the long struggle with the emotional adjustment that is necessary before the "outside world" can be risked. For the person of casual interest in the problem of the paraplegic patient this book will do far more toward a clarification of their needs and problems and especially toward an understanding of their feeling of safety in isolation and of their despair and detachment than will any amount of material conveyed nonchalantly on this all too popular subject in current magazines and newspapers.

Fortunately the author has avoided the maudlin — an easy error in treating of her subject. Nor has she shown the injured patient in all clean all moral completely deserving light. She has shown how this admittedly difficult group of patients can render all treatment futile by their own attitude of futility. She has indicated what all discerning doctors know, that is that if the patient can be helped by his doctors to realize fully the meaning of his condition and to accept it and to take up his life again on a new but by no means less exalted plane the greatest hurdle will have been passed. Through Janet the reader can learn why the intelligent patient has difficulty in accepting his new limitations well and through St. Leger's story the weaknesses of the last machine to control the human body.

Charles W. & Peter F. ... don't have  
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It is only simple truth to say that this comprehensive treatise so many years in the making will long serve both as an inspiration and guide to the student and practitioner of surgery. One can be very certain as Whipple has said, that only those who have worked with him can understand the time and effort that he has given to these bacteriological studies, and from these efforts the entire surgical profession and the patients for whom they are caring have benefited and will continue to benefit through the coming years.

SCHMIDT L. KOCH.

## BOOKS RECEIVED

Books received are acknowledged in this department, and such acknowledgment must be regarded as a sufficient return for the courtesy of the sender. Selections will be made for review in the interest of our readers and as space permits.

PRINCIPII DI CHIRURGIA DEL CERVELLO E DEL MIDOLLO SPINALE. By Africo Serra. Bologna: Lidao Cappelli, 1948.

HANDBOOK OF ORTHOPAEDIC SURGERY. By Alfred Rivers Shands, J. B.A. M.D. 3rd ed. St. Louis: The C. V. Mosby Co., 1948.

ANNUAL REPORT OF THE BARUCH COMMITTEE ON PHYSICAL MEDICINE FOR PERIOD 0 JAN 047 TO DEC 3 047.

TREATMENT & MANIPULATION IN GENERAL AND COX SOLUTING PRACTICE. By A. G. Timberliff Fisher. 5th ed. New York and London: Paul B. Hoeber Inc., 1948.

ESSENTIALS OF PATHOLOGY. By Laurence W. Smith, M.D. F.C.A.P. and Ed. in S. Gault, M.D., F.C.A.P. 3rd ed. Philadelphia and Toronto: The Blakiston Co., 1948.

HOSPITAL TRENDS AND DEVELOPMENTS. Edited by A. C. Bachmeyer, M.D. and Gerhard Hartman, Ph.D. New York: The Commonwealth Fund, 1948.

NURSED FOR THE FUTURE. REPORT PREPARED FOR THE NATIONAL NURSING COUNCIL. By Esther Lucile Brow. Ph.D. New York: Russell Sage Foundation, 1948.

OCCUPATIONAL MARKS AND OTHER PHYSICAL STIGMS. GUIDE TO PERSONAL IDENTIFICATION. By Francesco Rocchini, M.D. New York: Grune & Stratton, 1948.

STERILITY AND IMPAIRED FERTILITY. PATHOGENESIS, INVESTIGATION & TREATMENT. By Cedric Lane-Roberts, Albert Sherrman, Kenneth Walker, B. P. Wiesner and Mary Barton. New York and London: Paul B. Hoeber Inc., 1948.

THE NATION'S HEALTH: A TEN YEAR PROGRAM. A REPORT TO THE PRESIDENT. By Oscar R. E. Ing. Federal Security Administration. Washington: U. S. Government Printing Office, 1948.

A B-C's OF SULFONAMIDE AND ANTIBIOTIC THERAPY. By Percy H. Long, M.D. F.R.C.P. Philadelphia and London: W. B. Saunders Co., 1948.

NEUROSCIENTIFIC PATHOLOGY. By I. Mark Scheinker, M.D. Springfield, Ill.: Charles C. Thomas, 1948.

PERITONEAL ADHESIONS. By M. Digby Leigh, M.D. and M. Kathleen Belton, M.D. New York: The Macmillan Co., 1948.

MANAGEMENT IN OBSTETRICS. By Andrew M. Clay, M.D. F.R.C.S., F.R.C.O.G. London, New York, Toronto: Geoffrey C. Moberg, Oxford University Press, 1948.

FRACTURES & DISLOCATIONS. By Edwin O. Geckler, M.D. 4th ed. Baltimore: The Williams & Wilkins Co., 1948.

PLASTER OF PARIS TECHNIC. By Edwin O. Geckler, M.D. 2nd ed. Baltimore: The Williams & Wilkins Co., 1948.

METHODS IN MEDICAL RESEARCH. Vol. 1. Van R. Potter, Editor-in-Chief. Chicago: The Year Book Publishers, Inc., 1948.

THE STORY OF THE JOHNS HOPKINS FOUR GREAT DOCTORS AND THE MEDICAL SCHOOL THEY CREATED. By Bertram M. Bernheim, M.D. New York and Toronto: Whitteley House McGraw-Hill Book Co., Inc., 1948.

VIRAL AND RICKETTSIAL INFECTIONS OF MAN. Edited by Thomas M. Rivers, M.D. Philadelphia, London, and Montreal: J. B. Lippincott Co., 1948.

BRONCHOGENIC CARCINOMA AND ADENOMA WITH A CHAPTER: MEDIASTINAL TUMORS. By B. M. Fried, M.D. Baltimore: The Williams & Wilkins Co., 1948.

THE RADIOLOGY OF BONES AND JOINTS. By James F. Bradford, M.D. 4th ed. Baltimore: The Williams & Wilkins Co., 1948.

POLIO AND ITS PROBLEMS. By Roland H. Borg. With a Foreword by Basil O'Connor. Philadelphia, London, and Montreal: J. B. Lippincott Co., 1948.

DETAILED ATLAS OF HEAD AND NECK. By Raymond C. Truex, M.S., Ph.D. and Carl E. Kelner. New York: Oxford University Press, 1948.

THE THYROID AND ITS DISEASES. By J. H. Means, M.D. From the Thyroid Clinic of the Massachusetts General Hospital. 2nd ed. Philadelphia, London, and Montreal: J. B. Lippincott Co., 1948.

MEDICAL RESEARCH IN FRANCE DURING THE WAR (1939-1945). Thirty articles gathered and presented by Jean Hamburger. Foreword by Professor Pasteur Valley-Radot. Paris: Flammarion et Cie. New York: The Rockefeller Foundation, 1948.

November, 1948

# SURGERY

## GYNECOLOGY AND OBSTETRICS

*Supplement*

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Chapters XVI and XVII, "The Defense of the Human Body against Bacterial Infection" and "The Mechanism of the Secondary Defenses of the Body" are especially interesting both because of the historical background presented and the excellent portraits of the men who made outstanding contributions to the study of immunity and because of the clear exposition of the cellular and humoral factors involved in body immunity.

In Chapters XVIII XXII Surgical Principles in the Treatment of Infection Chemotherapy in Surgical Infections, "The Treatment of Surgical Infections with Zinc Peroxide" "The Bacteriophage Therapy of Surgical Infections" and Antibiotic

Therapy in Surgical Infections, the author presents a summary of the principles of prevention and treatment of infection as applied in surgical practice today and of the results that have been obtained with the modern weapons at the surgeon's command. Chapter XXII closes with a brief and very modest reference to bacitracin the antibiotic that was developed in the author's laboratory.

It is only simple truth to say that this comprehensive treatise so many years in the making, will long serve both as an inspiration and guide to the student and practitioner of surgery. One can be very certain as Whipple has said, that "only those who have worked with him can understand the time and effort that he has given to these bacteriological studies, and from these efforts the entire surgical profession and the patients for whom they are caring have benefited and will continue to benefit through the coming years."

STANLEY L. KOCK.

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Books received are acknowledged in this department, and such acknowledgment must be regarded as sufficient return for the courtesy of the sender. Selections will be made for review in the interest of our readers and as space permits.

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# INTERNATIONAL ABSTRACTS OF SURGERY

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## COLLECTIVE REVIEW

### THE SURGICAL PHYSIOLOGY OF THE SYMPATHETIC NERVOUS SYSTEM WITH SPECIAL REFERENCE TO CARDIOVASCULAR DISORDERS

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ORIGINALLY performed for the relief of epilepsy, glaucoma, migraine, and exophthalmic goiter, surgery on the sympathetic nervous system and its indications have undergone considerable modification since its introduction at the end of the last century by Alexander (1889), Jonnesco (1896), and Jaboulay (1899). The credit for being the first to realize the potential value of sympathetic interruption in the treatment of vasospastic disorders goes to Jaboulay (1899). It was he who developed periarterial sympathectomy and the operation was later popularized by his pupil, Leriche (1913). However as a result of our better understanding of the peripheral sympathetic pathways (Kramer and Todd, 1914; Woodard and Norrish, 1934) periarterial sympathectomy has since been entirely replaced by ganglionectomy and lately by preganglionic ramisection.

Originally, the indications for sympathectomy were few, and the operation was considered difficult to perform. It was carried out only by surgeons who had done a considerable amount of research in this field and were thus familiar with all the anatomical and physiological aspects of the subject. Within recent years, however, the indications for sympathectomy are continuously becoming more numerous and more clearly defined and the approach to the sympathetic system has

been very much simplified. As a result, the operation has been added to the repertoire of most general surgeons, many of whom must be out of touch with recent scientific developments and knowledge of the recognized prerequisites for successful operation. Thus only can it be explained that the results obtained have been extremely varied, and, in fact, diametrically opposed in well known clinics. This is best illustrated by quoting Samuels (1934). In my experience these operations (sympathectomy and ganglionectomy) have no place whatsoever in the treatment of gangrene or in any phase of thromboangitis obliterans,' and in the latest edition of his textbook on diseases of the peripheral arteries (1940) "The magnitude of the procedure and the great operative risk as well as a fairly high mortality certainly do not justify its performance in either thromboangitis obliterans or arteriosclerosis. This is entirely opposed to our experience and that of many other clinics. Our results have always been very gratifying provided the operation was based on definite indications. I have, however to state emphatically that the operation must not be carried out as a last resort and that no operation is able to revive an already gangrenous limb!

The extraperitoneal approach to the lumbar sympathetic, as described by Leriche (1926, 1933) and by Pearl (1937) and the transthoracic approach to the thoracic sympathetic as first described by Goetz and Marr (1944) have certainly reduced the magnitude of the operation, and in

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our series of over 300 consecutive sympathectomies<sup>1</sup> carried out during the last 14 years, there has been not a single operative death.

A sound knowledge of the anatomy and of the physiology of the field in question is even more essential for carrying out a successful sympathectomy than for most other operations. Yet this is made difficult by the fact that there are few short treatises presenting the subject from the surgeon's point of view and the available charts of the sympathetic pathways do not furnish the information essential to the surgeon. We have therefore endeavored to present in this article such facts of the anatomy and applied physiology of the sympathetic nervous system as are of importance to the surgeon.

When we say *sympathetic* nervous system, we use the words in the narrow sense. I.e., we do not include the *parasympathetic* nervous system. Furthermore, we shall be dealing almost exclusively with the motor the efferent side of the sympathetic arc, leaving the afferent or sensory part entirely out of consideration, with the exception of the afferent fibers to the heart.

#### HISTORICAL

The first account of the ganglia of the sympathetic nervous system and of the splanchnic nerves was given by Galen in the second century (Sheehan, 1936) and a clear anatomical concept of the sympathetic chain and its connections was already known to Etienne (1545) Eustachio (1552) and Willis (1664). The vascular (sympathetic) nerves, however were not discovered until the famous experiments of Claude Bernard in 1852.

Etienne, Eustachio and Willis all gave the sympathetic chain a cerebral origin (similar to the cranial nerves) a mistake later corrected by the French surgeon, François Pourfour du Petit in 1727 after he had ascertained that the fibers in the carotid canal were ascending instead of descending nerve filaments.

The term "sympathetic" was introduced by Winslow (1732) and Bichat (1800) was the first to correlate the sympathetic nervous system with the metabolic functions of the body. He noticed to use his own words, that the "nerves of the ganglia are distributed everywhere to the circulatory system," and that "it is only with the arteries that they are introduced into the organ" (Sheehan 1936). It was, however, only following the discovery of nonstriated muscles by Johannes Mueller (1834) and the demonstration of their presence in arteries by Koelliker (1846) that

Claude Bernard could discover the vasomotor nerves and their tonic effect on the blood vessels (1851). Only later was it recognized that the pilorectors (Schiff 1870) and the sweat glands (Luchsinger 1877 1880) were also innervated by the sympathetic system.

The credit for recognizing that the sympathetic outflow originates in the thoracolumbar region only and for first postulating the existence of two antagonistic systems of nerves for the control of the involuntary musculature goes to Gaskell (1886). Langley (1898) introduced the term "autonomic nervous system" and (1893) gave us the concept of preganglionic and postganglionic neurons, the practical importance of which has only recently been fully realized.

When Langley (1901) discovered that the injection of epinephrine into the blood stream acts like sympathetic stimulation, and Elliot (1913) found that the suprarenal medulla receives a preganglionic sympathetic supply it became clear that the suprarenal gland forms an integral part of the sympathetic nervous system. This sympathico-adrenal system has been designed to act as a single unit in case of emergency to ensure the integrated action of the body toward changes in its internal and external environment (Cannon 1920, 1928).

The sympathetic nervous system first attracted the attention of surgeons about 50 years ago.

#### THE SYMPATHETIC REPRESENTATION IN THE CORTEX

Although the physiological and clinical literature contains numerous reports concerning the central control of cardiovascular functions, very little is known about the exact cortical representation of the autonomic nervous system. The evidence furnished by earlier authors, that cerebral stimulation alters the heart rate and blood pressure (Schiff 1875 Danilewski 1875) loses much of its value since Bard (1929) has demonstrated that it can be "accounted for on the basis of spread of strong, stimulating currents to subcortical regions," resulting in an unphysiological discharge. A similar objection holds good for the value of such observations as that by Zenner and Kramer (1909) who reported disappearance of the pulse from the right wrist while attempting to remove a meningioma apparently in the left frontoparietal region.

Recent investigations, not subject to such criticism, have shown that there are apparently no separate cortical areas for sympathetic and parasympathetic reactions. In the cat, dog, and monkey the autonomic system is affected as a whole from one area of the cortex, and the question

<sup>1</sup>This figure does not include the patients who have undergone transdiaphragmatic sympathectomy for hypertension.

whether we get a sympathetic or parasympathetic response depends entirely upon the physiological state of the animal at the time of stimulation (Crouch and Thompson 1939). Watts and Fulton (1934) could show in monkeys that stimulation of the premotor area produced cardiovascular effects as well as increase in intestinal peristalsis. On the other hand, excessive sympathetic activity such as panting increase in heart rate, increased production of adrenaline, loss of bladder control gastric hypomotility and intestinal stasis followed by intussusception, have been described following the bilateral extirpation of the premotor area (Watts and Fulton, 1934; Fulton *et al.*, 1934; Kennard 1945). Removal of the premotor area in monkeys also paralyzes the mechanism for reflex vasodilatation in the corresponding limb. Such experimental animals, when placed in a warm atmosphere, will exhibit normal reflex vasodilatation in all extremities except the affected one which remains cool because vasodilatation does not take place. From experiments in cats, monkeys, and the chimpanzee Hoff and Green (1936) and Green and Hoff (1937) concluded that there is a mechanism by which the cortex can influence the state of the cardiovascular system, and the distribution of the blood to various regions of the body. Through this mechanism the cortex may bring about a finer adjustment of the activity of the heart and circulation in accordance with the exigencies of the external environment and the immediate activities of the skeletal musculature. Excitation of the motor cortex results in a redistribution of blood decreasing the supply of the abdominal viscera but increasing that to those parts which would be made active by the simultaneous excitation of the motor efferent pathways from the same areas of the cortex.

Although caution has to be observed when applying experimental findings in laboratory animals to man, nevertheless, evidence is accumulating that in man too the motor area of the frontal lobe is sympathicomotor and exerts a definite influence on the cardiovascular system via the lower autonomic centers. Emotional disturbances and blood flow which is dependent upon the integrity of the sympathetic pathways (Goetz 1943, 1946). Persons have been observed who seemed to have voluntary control over their sympathetic functions (Clymer 1870; Maxwell 1902). Lindsley and Sassman (1938) reported on one such patient who was able to produce voluntary piloerection, associated with an increase in heart rate, depth of respiration, and blood pressure as well as dilatation of the pupils. Simultaneous records of elec-

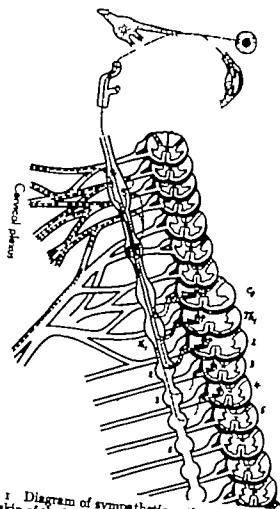


Fig. 1. Diagram of sympathetic pathways to structures of the skin of the head and neck and oculopupillary apparatus, with special reference to preganglionic pathways. The uninterrupted preganglionic fibers are constant pathways the interrupted ones are not present in all cases.

trical potentials from the premotor and an independent region showed characteristic changes over the premotor area only during the period of peripheral autonomic discharge. The authors interpret this as evidence of autonomic representation in the premotor area of the cortex in man. Just as severance of somatic cortical control results in the removal of inhibitions so does the liberation of the hypothalamic nuclei from their cerebral connections result in an increase in vasomotor pilomotor and sudomotor activity. Removal of the cortex in cats leads to spontaneous outbursts of motor activity resembling responses to rage and fear for which the term 'sham rage' has been suggested by Cannon and Britton. Head and Holmes (1911) originally assumed that loss of cortical inhibition was the underlying lesion in the thalamic syndrome. However this interpretation has been questioned (Lashley, 1938). Symptoms similar to sham rage have recently been described by Sjöquist (1941) and Worts and Maurer (1942) in patients with epileptic seizures and fol-



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Fig. 3.

Fig. 3. Sweating test in a patient after cauterization of left second thoracic ganglion. Note absence of sweating of left half of face, neck, and upper thorax, as well as absence of Horner's syndrome.



Fig. 4.

Fig. 4. Same patient as in Figure 3, posterior aspect.

disappeared after extirpation of the stellate ganglion. The phenomenon is, therefore a true sympathetic response.

A vasoconstrictor center in the caudal, and a vasodilator center in the oral, part of the hypothalamus has been postulated by Beattie (1932). By recording the discharges from the preganglionic neurons to the cervical sympathetic during stimulation of the hypothalamus Broek and Pitts could establish that the hypothalamus is not directly connected to the spinal sympathetic motor neurons but that the medullary sympathetic centers are interposed and may actually buffer the effect of hypothalamic stimulation.

The evidence which is accumulating concerning hypothalamic control in man seems to agree well with these findings in animals. White (1940 [200]) found, during operation on 5 conscious patients that electrical stimulation of the region of the paraventricular nucleus of the hypothalamus produced abrupt acceleration of the heart rate (up to 160 in one patient) accompanied by a moderate rise in the blood pressure. Similarly, stimulation of the anterior hypothalamus in the region of the preoptic nucleus caused bradycardia. Grinker and Serota (1938) on transphenoidal stimulation of the hypothalamic region, could demonstrate acceleration of the heart rate and respiration increase in vasomotor tone rise in the blood pressure dilatation of the pupils, sweating and contraction of the bladder.

In addition to these direct observations on the human hypothalamus, there are numerous clinical observations which point in the same direction. Tumors and other lesions which compress or destroy the walls of the third ventricle frequently cause disturbances of autonomic functions. One of the patients with a hypothalamic tumor observed by Peet and Kahn (1936) developed, amongst other symptoms severe vasoconstriction with cyanosis and sweating of the extremities simulating Raynaud's syndrome. A patient observed by Penfield (1929) who had a tumor of the choroid plexus in the third ventricle, had attacks of what Penfield called diencephalic autonomic epilepsy i.e., attacks of cutaneous vasodilatation of the face and arms salivation profuse sweating, pilomotor activity dilatation of the pupils increase in the heart rate, spasm of the sphincters, and rise in the blood pressure. A similar symptomatology was later reported by McLean (1934) in a case of tumor in the wall of the third ventricle. Sjögquist (1941) observed this syndrome with acute obstruction of the cerebrospinal circulation and Page (1935) reported on 11 patients with severe, essential hypertension simulating diencephalic stimulation.

Sjögquist is of the opinion that Penfield's diencephalic autonomic epilepsy is the result of an acute distention of the third ventricle which produces stimulation of the autonomic centers lying within its wall.

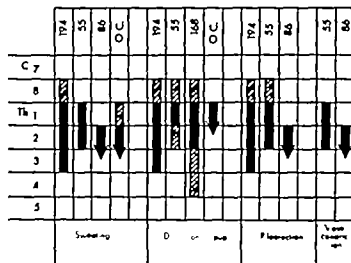


Fig. 2. Chart demonstrating segmental distribution of sympathetic outflow of fibers dilating pupil, sweat fibers, piloerector and vasoconstrictor fibers to the structures of the neck and the head, according to various authors. Black—outflow present in all cases. Shaded—outflow present in some cases. Numbers across top of chart refer to the references of the various authors. O.C.—on cases.

lowing destruction of the cortical centers from carbon monoxide poisoning and insulin hypoglycemia. Similarly Chevalier (1867) Eulenburg and Landois (1876) and Gowers (1888) had already noted vasomotor disturbances in cases of hemiplegia, and numerous authors have since clearly described differences between the normal and paralyzed extremity in color, skin temperature, blood pressure, sweating, and pilomotor reactions due to interruption of inhibitory fibers connecting the cortex to the vasomotor centers in the hypothalamus and the medulla (Bastian, 1886; Rossolimo 1895; Régnard, 1913; Danilewsky *et al.* 1926; 1931; Brickner 1930; Olsen, 1933; Munkofski 1933; Popper, 1933 and Uprus *et al.*, 1935). More recently Pilcher, Wynnt, and Carney (1941) demonstrated unilateral sympathetic overactivity following blocking of the left middle cerebral artery by a large embolus. They, too, interpreted this as a release phenomenon of cortical inhibitions.

#### THE HYPOTHALAMIC CONTROL OF THE SYMPATHETIC

There is a vast literature dealing with evidence of sympathetic representation within the hypothalamus and the wall of the third ventricle. Stimulation of the posterior nuclei in animals results in widespread sympathetic activity with all its characteristic responses, such as: rise in blood pressure and heart rate, pupillary dilatation, retraction of

nictitating membrane, whitening of the palpebral fissure, erection of hair, sweating, abolition of gastrointestinal peristalsis, contraction of the bladder and emotional excitement (Karpus and Krendl, 1909; 1918; 1928; Ranson and Magoun, 1933; Kabat, Magoun, and Ranson, 1935; Kabat, Anson, Magoun, and Ranson 1935; Stavsky, 1936; Ectors *et al.* 1938; Hare and Geobegan, 1939; Walker 1940 and Pitts *et al.* 1941). Housay and Molinelli (1925) and Magoun *et al.* (1937) have demonstrated that there is secretion of adrenaline as well. All these cardiovascular responses are independent of descending pathways from the cerebral cortex (Morrison and Rioch 1937; Magoun 1938) and are not influenced by the extirpation of the hypophysis and the adrenals (Karpus and Krendl, 1927; Stavsky 1936). They are however promptly abolished by resection of the thoracic sympathetic chain and the injection of a sympathetic paralyzant, such as ergotamine tartrate (Jaegher and Bogaert, 1935). They are, therefore, the result of stimulation of a projection system taking its origin within the hypothalamus.

Further evidence of hypothalamic control of cardiovascular functions was furnished by Beattie, Brow and Long (1930), who produced ventricular extra systoles by stimulating the posterior part of the lateral wall of the third ventricle. This was corroborated by Kabat *et al.* (1934) and by Van Bogaert (1935) who showed that the extra systoles were not affected by section of the vagi but



Fig 3



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Fig. 3. Sweating test in a patient after cauterization of left second thoracic ganglion. Note absence of sweating of left half of face, neck, and upper thorax, as well as absence of Horner's syndrome.

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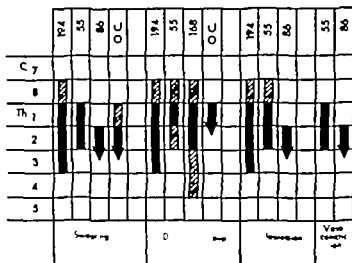


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Fig. 4. Same patient as in Figure 3, posterior aspect.

disappeared after extirpation of the stellate ganglion. The phenomenon is, therefore a true sympathetic response.

A vasoconstrictor center in the caudal, and a vasodilator center in the oral, part of the hypothalamus has been postulated by Beattie (1932). By recording the discharges from the preganglionic neurons to the cervical sympathetic during stimulation of the hypothalamus, Bronk and Pitts could establish that the hypothalamus is not directly connected to the spinal sympathetic motor neurons but that the medullary sympathetic centers are interposed and may actually buffer the effect of hypothalamic stimulation.

The evidence which is accumulating concerning hypothalamic control in man seems to agree well with these findings in animals. White (1940 [1900]) found during operation on 5 conscious patients, that electrical stimulation of the region of the paraventricular nucleus of the hypothalamus produced abrupt acceleration of the heart rate (up to 160 in one patient) accompanied by a moderate rise in the blood pressure. Similarly stimulation of the anterior hypothalamus in the region of the preoptic nucleus caused bradycardia. Grinker and Serota (1938) on transphenoidal stimulation of the hypothalamic region, could demonstrate acceleration of the heart rate and respiration, increase in vasomotor tone, rise in the blood pressure, dilatation of the pupils sweating and contraction of the bladder.

In addition to these direct observations on the human hypothalamus there are numerous clinical observations which point in the same direction. Tumors and other lesions which compress or destroy the walls of the third ventricle frequently cause disturbances of autonomic functions. One of the patients with a hypothalamic tumor, observed by Peet and Kahn (1936) developed amongst other symptoms, severe vasoconstriction with cyanosis and sweating of the extremities simulating Raynaud's syndrome. A patient observed by Penfield (1929) who had a tumor of the choroid plexus in the third ventricle, had attacks of what Penfield called 'diencephalic autonomic epilepsy' i.e., attacks of cutaneous vasodilatation of the face and arms, salivation, profuse sweating, pilomotor activity dilatation of the pupils, increase in the heart rate, spasm of the sphincters, and rise in the blood pressure. A similar symptomatology was later reported by McLean (1934) in a case of tumor in the wall of the third ventricle. Sjöquist (1941) observed this syndrome with acute obstruction of the cerebrospinal circulation and Page (1935) reported on 11 patients with severe, essential hypertension simulating diencephalic stimulation.

Sjöquist is of the opinion that Penfield's diencephalic autonomic epilepsy is the result of an acute distention of the third ventricle which produces stimulation of the autonomic centers lying within its wall.

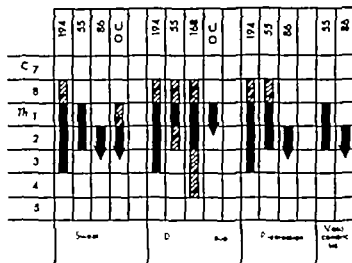


Fig. 2. Chart demonstrating segmental distribution of sympathetic outflow of fibers dilating pupil, sweat fibers, piloerector and vasoconstrictor fibers to the structures of the neck and the head, according to various authors. Black—outflow present in all cases. Shaded—outflow present in some cases. Numbers across top of chart refer to the references of the various authors. O.C.—own cases.

following destruction of the cortical centers from carbon monoxide poisoning and insulin hypoglycemia. Similarly Chevalier (1867) Eulenburg and Landois (1876) and Gowers (1888) had already noted vasomotor disturbances in cases of hemiplegia, and numerous authors have since clearly described differences between the normal and paralyzed extremity in color skin temperature, blood pressure sweating, and pilomotor reactions due to interruption of inhibitory fibers connecting the cortex to the vasomotor centers in the hypothalamus and the medulla (Bastian, 1886 Rossolimo 1895 Régnard, 1913 Danekopolu *et al* 1926 1931 Brickner 1930 Olsen, 1933 Minkowski 1933 Popper, 1933 and Uprus *et al* 1935) More recently Pilcher Wyatt, and Carney (1941) demonstrated unilateral sympathetic overactivity following blocking of the left middle cerebral artery by a large embolus. They, too interpreted this as a release phenomenon of cortical inhibitions.

#### THE HYPOTHALAMIC CONTROL OF THE SYMPATHETIC

There is a vast literature dealing with evidence of sympathetic representation within the hypothalamus and the wall of the third ventricle. Stimulation of the posterior nuclei in animals results in widespread sympathetic activity with all its characteristic responses, such as rise in blood pressure and heart rate pupillary dilatation, retraction of

nictitating membrane widening of the palpebral fissure erection of hair sweating, abolition of gastrointestinal peristalsis, contraction of the bladder and emotional excitement (Karpus and Kreidl 1909 1918, 1928 Ranson and Magoun, 1933 Kabat Magoun, and Ranson, 1935 Kabat, Anson Magoun, and Ranson 1935 Stavsky 1936 Ectors *et al* 1938 Hare and Geobegan, 1939 Walker 1940 and Pitts *et al* 1941) Housley and Molinelli (1935) and Magoun *et al* (1937) have demonstrated that there is secretion of adrenaline as well. All these cardiovascular responses are independent of descending pathways from the cerebral cortex (Morrison and Bloch 1937 Magoun 1938) and are not influenced by the extirpation of the hypophysis and the adrenals (Karpus and Kreidl, 1927 Stavsky 1936) They are however promptly abolished by resection of the thoracic sympathetic chain and the injection of a sympathetic paralyzant, such as ergotamine tartrate (Jaegher and Bogaert, 1935) They are, therefore the result of stimulation of a projection system taking its origin within the hypothalamus.

Further evidence of hypothalamic control of cardiovascular functions was furnished by Beattie, Brow and Long (1930), who produced ventricular extra systoles by stimulating the posterior part of the lateral wall of the third ventricle. This was corroborated by Kabat *et al* (1934) and by Van Bogaert (1935) who showed that the extra systoles were not affected by section of the vagi but

Evidence of these centers in man is still scarce and unconvincing. Starling (1925) first suggested that persistent hypertension may be the result of local asphyxia in the medulla. Various other authors (Nordmann and Mueller 1932, Salus 1932, Raab 1934) have demonstrated changes in the cytology of the medulla in neurological patients who prior to death suffered from rising blood pressure which was *not* due to cardiovascular or renal pathology. They believe that these changes are of considerable significance with regard to the pathogenesis of hypertension.

Today it can be regarded as certain that in man there is bulbar representation of sweating, erection of hair and dilatation of the pupils and that a well localized bulbar area controls the sympathetic outflow to the entire vascular tree, i.e. arteries and arterioles as well as the veins, including the spleen. Its tonic activity may be increased or decreased by afferent nerve impulses or by variations in its blood supply as well as by changes in the carbon dioxide tension (Raab 1929). There is, in addition, evidence that centers controlling the cardiac activity are in close relation to these centers of vasomotor activity. The proximity of the vasomotor center to the respiratory center has long been established and, indeed, respiratory fluctuations are often imposed upon the stream of sympathetic vasomotor impulses which can easily be demonstrated in plethysmographic records of the peripheral blood flow (Goetz, 1943, 1946).

#### THE SPINAL CENTERS AND THE THORACOLUMBAR OUTFLOW OF THE SYMPATHETIC

Surgeons are usually more familiar with the centers of sympathetic activity situated in the spinal cord than with the higher supraspinal centers. From the higher centers, vasomotor, sudomotor and pilomotor fibers descend along the extrapyramidal tracts in the posterior longitudinal fasciculus and the vestibulospinal tracts into the anterolateral columns of the spinal cord. There they establish synapses with the ganglion cells in the lateral horns constituting the spinal sympathetic motor centers. The axons of these ganglia in the lateral horn are medullated and proceed to the corresponding sympathetic paravertebral ganglia via the anterior roots and the rami communicantes to synapse with ganglion cells in the paravertebral ganglia. These white (medullated) fibers are known as preganglionic fibers. The axons of the ganglion cells in the paravertebral ganglia (unmedullated, hence gray fibers) reach the effector organs, either by joining the spinal nerves as in the somatic regions, or by joining the blood vessels, as in the visceral (splanchnic) areas.



Fig. 8. Dorsal aspect of same patient as in Figures 3 and 4, but following bilateral removal of the second thoracic ganglion.

It is important to realize that in man the sympathetic centers in the spinal cord, i.e. the lateral horn extend only from  $T_1$  to  $L_2$  (Harman, 1898, Pick and Sheehan, 1946)—hence the term thoracolumbar division of the sympathetic. The paravertebral sympathetic ganglia, on the other hand, extend right down to the coccygeal region and up into the neck where, through fusion, there are only three instead of eight cervical ganglia. They are the inferior cervical ganglion, the fused seventh and eighth cervical ganglia, the middle cervical ganglion, being a fusion of the fifth and sixth, and the superior cervical ganglion, representing the upper four cervical ganglia. There is, therefore, no sympathetic outflow through the lumbar and sacral region below  $L_2$ . The preganglionic fibers to the cervical ganglia and to the ganglia below  $L_2$  must reach them along the sympathetic cord, i.e. via the first thoracic ganglion in the case of the cervical ganglia and via  $L_1$  in the case of the lumbar and sacral ganglia (Figs. 1, 9, and 15).

Harman (1900) had already noticed that the limit of the preganglionic outflow may vary according to the fixation of the brachial plexus. As the plexus moves up a segment (prefixed) the preganglionic outflow moves up one segment to  $C_6$  and in the case of a postfixed brachial plexus the second thoracic ganglion may become the





Fig. 5.



Fig. 6.



Fig. 7.

Fig. 5. Sweating test following cauterization of the left second thoracic ganglion. Note that face and neck are still sweating and that therefore there must be an outflow from T<sub>12</sub> in this patient.

Fig. 6. Same patient as in Figure 5. Not complete absence of sweating in the left arm. No loss of sweating

over the anterior aspect of the chest and in the face. No Horner's syndrome.

Fig. 7. Same patient as in Figures 5 and 6 following bilateral removal of the second thoracic ganglion. Note complete symmetry of loss of sweating in the dorsal aspect indicating that pattern is characteristic in this patient.

Summarizing the available evidence of hypothalamic control of sympathetic function, we can say that it points clearly to the presence of two distinct mechanisms, one in the posterior portion producing a co-ordinated response of numerous *sympathetic* reflexes, and the other in the anterior portion producing a similar co-ordinated response of *parasympathetic* outflow (Cushing, 1932; Beatle, 1933). Each of these seems to be directed toward the maintenance of a constant internal environment. The cortex however exerts a controlling (inhibitory) influence upon these mechanisms (vide p. 419). In addition, we must not lose sight of the fact that the hypothalamus, and thus the sympathetic nervous system, through its influence upon the pituitary body is working hand in glove with the entire endocrine system and thus takes part in the control of the latter.

#### THE SYMPATHETIC CENTERS IN THE MEDULLA

Following the discovery of the vasomotor nerves by Claude Bernard workers in Ludwig's laboratory were able to demonstrate that these vasomotor nerves were under the influence of higher centers in the medulla (Owsjannikow 1871; Dittmar

1873). They found that stimulation of the central end of the sciatic nerve resulted in a rise in blood pressure, even after all the brain above the medulla had been removed. More recently Ranson (1916) and Ranson and Billingsley (1916) exploring the floor of the fourth ventricle with stimulating electrodes, identified a vasoconstrictor and a vasodilator center as well as an area which may correspond to what Porter (1913) had termed the "vasotonic" (in contrast to the vasoreflex) center. These findings of Ranson and his coworkers were challenged by Scott (1925) but were confirmed recently in carefully controlled experiments by Alexander (1946). He could produce a reduction in the blood pressure and cardioaccelerator tone by removing the portion of the medulla located as the pressor center i.e. in the lateral reticular formation of the rostral two-thirds of the medulla. He also demonstrated a depressor center which includes the greater part of the medial reticular formation in the caudal half of the medulla, and demonstrated once more that the pressor reflex which is produced by stimulation of the sciatic nerve depends upon the integration of the bulbar centers.

employing the preganglionic sympathectomy technique. The whole problem is at present being investigated by us and we are making use of more comprehensive methods of measuring the blood flow and vasomotor tone than were employed by previous authors.

Fatherree and his coworkers demonstrated that removal of the ganglia (postganglionic sympathectomy) in man does not produce nearly as great a sensitization of smooth muscle as it does in the monkey. This gives added point to our contention that the technique of the operations on the sympathetic system should be based on physiological data obtained from man and not from animals.

Knowledge of the preganglionic sympathetic outflow in man is still incomplete and often in correctly stated, largely because it has been deduced by indirect methods or by attempts to apply to man the findings in laboratory animals.

This is further complicated by the fact that it has been found that the fibers of one anterior root may run up and down the paravertebral chain and that one preganglionic sympathetic neuron may synapse with as many as six to nine (Langley 1900) or even twenty postganglionic neurons (Billingsley and Ranson 1918). This explains why stimulation of one white ramus, containing preganglionic fibers of one cord segment only causes sympathetic effects over many skin segments. For instance, stimulation of the anterior root of  $Th_2$  causes erection of hair over an area extending from  $Th_1$  to  $S_4$ , i.e. on the whole leg and on the abdomen to well above the umbilicus. It causes sweating in all the lumbar and sacral dermatomes. Similarly stimulation of the anterior root of  $Th_4$  causes erection of hair over an area extending from  $C_4$  to  $Th_4$  (Foerster 1936) or to give another example, stimulation of one anterior root containing preganglionic fibers to the hand (see page 428) results in simultaneous vasomotor changes in all fingers of that hand (Ray *et al.*, 1943). From such evidence it appears that each ganglion cell in the paravertebral ganglia is innervated by preganglionic fibers from a great number of spinal segments. It is in this way that the characteristic diffuse discharge from the sympathetic is achieved. From all this emerges the point that, unless we achieve interruption of all preganglionic pathways, there can be no permanent loss of sympathetic activity to the area in question.

Therefore every operation on the sympathetic, in order to be successful has to be (1) anatomically complete (2) preganglionic in type, and (3) extensive enough to guard against future regeneration of interrupted fibers.

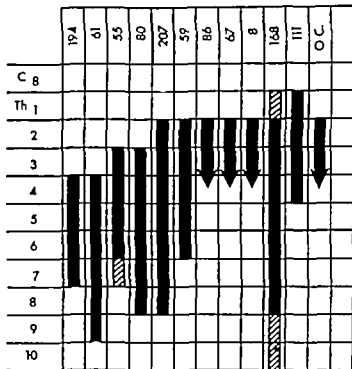


Fig. 10 Diagrammatic representation of sympathetic outflow supplying the upper extremities, according to various authors. For explanation see text. Black—outflow present in all patients shaded—outflow present in some. The arrows indicate that lower limit was not determined. Numbers across top of chart refer to the reference of the authors. O.C.—own cases.

Any modern schematic representation of the sympathetic system should take due consideration of these principles which constitute the prerequisites for successful operations on the sympathetic nervous system.

#### THE SYMPATHETIC INNERVATION OF THE VARIOUS REGIONS

To make practical the afore-mentioned principles, a chart of the sympathetic innervation of the extremities and various organs in man should furnish the surgeon with the following information (a) the origin and course of the preganglionic fibers, (b) their synapsis with the postganglionic neuron, and (c) the course and distribution of the postganglionic fibers. We therefore deal with the various regions and trace the pathways in that order.

*The sympathetic supply of the skin of the head, the neck and the oculo-pupillary fibers*

a. Origin of the preganglionic fibers—commonly in the lateral horn of  $Th_1$  and  $Th_2$ , occasionally in  $C_8$  and in  $Th_{3-4}$  (Figs. 1 and 2)

b. Course of the preganglionic fibers—ascending in the sympathetic trunk.

c. Synapsis of the preganglionic with the postganglionic neurons—in the superior cervical sym-

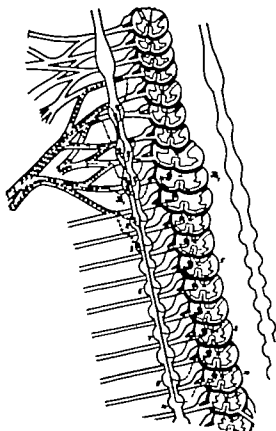


Fig. 9. Diagram showing preganglionic and postganglionic sympathetic fibers to the upper extremity. The uninterrupted preganglionic fibers are present in all cases; the interrupted ones are present in some cases. The postganglionic fibers indicated by a cross-line signify Kuntz's nerve.

highest cranial outflow Foerster (1936) and Goetz and Marr (1944) have made similar observations. Correspondingly  $L_4$  instead of  $L_5$  may become the lowest segment with sympathetic outflow.

Thus the peripheral sympathetic consists of three components: (1) preganglionic fibers taking their origin in the lateral horn (medullated, hence white ram); (2) paravertebral ganglia; and (3) postganglionic fibers (nonmedullated, hence gray ram).

#### PHYSIOLOGICAL CONSIDERATIONS AND PREREQUISITES FOR SUCCESSFUL SYMPATHECTOMY

Toward the end of the last century various authors demonstrated that in animals extirpation of the ganglia and degeneration of the sympathetic nerves induce an increased response of the affected organ to adrenaline. This sensitization phenomenon is found in all smooth muscle which is under the control of adrenergic nerve impulses.

It has been reported for the denervated heart (Cannon, Lewis, and Britton 1926) the pupil (Meltzer and Auer 1904; Meltzer 1904) and the nictitating membrane (Cannon and Rosenbluth, 1937, 1939) as well as for the peripheral vascular tree (Elliot, 1905; Freeman, Smithwick, and White 1934; White, Okelberry and Whitelaw 1936; Atlas, 1941[8]). Increased sensitivity to adrenaline is registered after interruption of either preganglionic or postganglionic fibers (Elliot, 1905; Grant, 1935; Ascroft, 1937). The postganglionic operation, however, renders the structures from two to three times more sensitive than preganglionic section (Hampel 1935). Ascroft calculated that the sensitivity increases three times following section proximal to the ganglion, but ten times following the postganglionic interruption. McCloskie *et al.* (1937) found that this hyperreaction may become sufficiently intense to produce necrosis of the skin when adrenaline is injected intracutaneously in the lower forelimb of a dog after removal of the stellate ganglion.

Hypersensitivity to adrenaline following ganglionectomy or interruption of the postganglionic fibers constitutes a complicating factor in cases in which surgery is contemplated. It may actually bring a technically well planned operation into disrepute. It has been blamed for the relatively poor results of cervicothoracic ganglionectomy for the relief of vasospasm (Telford, 1935; Smithwick, 1936; Cannon, 1937; Learmonth, 1937) and some authors (White, Okelberry and Whitelaw, 1936; Smithwick, Freeman, and White, 1934) believe that it accounts for the recurrence of vasospasm in Raynaud's phenomenon. Ascroft (1937) and White (1940[201]) have actually demonstrated in monkeys that the good results of a preganglionic ramisection can be vitiated if the corresponding ganglia are subsequently resected. Ganglionectomy has therefore been entirely replaced by preganglionic ramisection, as suggested by Telford (1935) and by Smithwick (1936). For this reason the exact knowledge of the origin and the course of the preganglionic fibers to the various regions has become as essential as their postganglionic supply. There are, however, authors who do not subscribe to this view. Fothergill and Allen (1938) and Fothergill, Adson, and Allen (1940) showed that, although there was an increase in the sensitivity of the blood vessels to adrenaline after sympathectomy there was no material difference whether the operation was of the preganglionic or postganglionic type. Grimson (1946) points out that the unsatisfactory results obtained in the upper extremities following sympathectomies have not been materially improved by operations

employing the preganglionic sympathectomy technique. The whole problem is at present being investigated by us and we are making use of more comprehensive methods of measuring the blood flow and vasomotor tone than were employed by previous authors.

Fatherree and his coworkers demonstrated that removal of the ganglia (postganglionic sympathectomy) in man does not produce nearly as great a sensitization of smooth muscle as it does in the monkey. This gives added point to our contention that the technique of the operations on the sympathetic system should be based on physiological data obtained from man and not from animals.

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This is further complicated by the fact that it has been found that the fibers of one anterior root may run up and down the paravertebral chain and that one preganglionic sympathetic neuron may synapse with as many as six to nine (Langley 1900) or even twenty postganglionic neurons (Billingsley and Ranson 1918). This explains why stimulation of one white ramus, containing preganglionic fibers of one cord segment only causes sympathetic effects over many skin segments. For instance, stimulation of the anterior root of  $Th_2$  causes erection of hair over an area extending from  $Th_1$  to  $S_4$ , i.e. on the whole leg and on the abdomen to well above the umbilicus. It causes sweating in all the lumbar and sacral dermatomes. Similarly stimulation of the anterior root of  $Th_4$  causes erection of hair over an area extending from  $C_4$  to  $Th_4$  (Foerster 1936), or, to give another example, stimulation of one anterior root containing preganglionic fibers to the hand (see page 428) results in simultaneous vasomotor changes in all fingers of that hand (Ray *et al.*, 1943). From such evidence it appears that each ganglion cell in the paravertebral ganglia is innervated by preganglionic fibers from a great number of spinal segments. It is in this way that the characteristic diffuse discharge from the sympathetic is achieved. From all this emerges the point that, unless we achieve interruption of all preganglionic pathways, there can be no permanent loss of sympathetic activity to the area in question.

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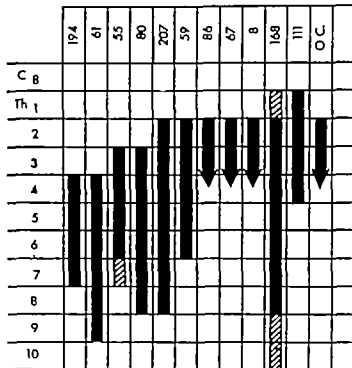


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*The sympathetic supply of the skin of the head, the neck and the oculosupillary fibers*

a. Origin of the preganglionic fibers—commonly in the lateral horn of  $Th_1$  and  $Th_2$  occasionally in  $C_8$  and in  $Th_{1-4}$  (Figs. 1 and 2)

b. Course of the preganglionic fibers—ascending in the sympathetic trunk.

c. Synapsis of the preganglionic with the postganglionic neurons—in the superior cervical sym



Fig. 1.

Fig. 1. Sweating pattern following canterization of left second thoracic ganglion. Note complete absence of sweating of whole upper extremity.



Fig. 2.

Fig. 2. Same patient as in Figure 1 following bilateral removal of the

pathetic ganglion except for a few terminating in the middle cervical ganglion.

d. Course of the postganglionic fibers—they join the internal carotid for the structures of the orbit, the external carotid for the skin of the face, and the salivary glands and the cervical plexus ( $C_1$  to  $C_4$ ) for the skin of the neck. (Some fibers arising in the superior cervical ganglion join the phrenic nerve—Hovellacque, 1927.)

e. Comment. Exact information as to the sympathetic supply to the head and neck and to the ciliospinal centers in man is available from studies of Foerster (1936, 1939), Thomas (1926), Head and Riddoch (1917) and more recently from Hyndman and Wolkin (1942), Ray *et al.* (1943) and Sheehan (1941). The data are tabulated in Figure 2. Foerster stimulated the anterior roots and actually observed the individual qualities of sympathetic action. These were his findings (Fig. 2). If a strong sympathetic response was obtained on stimulation of the anterior root of  $Th_1$ , stimulation of  $Th_2$  caused a less definite response and vice versa. Dilatation of the pupil may be observed after stimulation of the roots of  $C_4$ ,  $Th_1$  and  $Th_2$ , but if on stimulation of  $C_4$  a definite effect is observed, there will be none from stimu-

lation of  $Th_2$ , and vice versa. Stimulation of  $Th_1$  therefore, invariably produced a strong dilatation of the pupil in all cases. As for the vasoconstrictor and sweating fibers, they arose in the first and second thoracic segments only while piloerection could be obtained on stimulation of the anterior root of  $C_4$  as well. Thomas' findings were slightly different—he obtained sweating, dilatation of the pupil, and piloerection on stimulation of the anterior root of  $C_4$  down to  $Th_2$ . Ray and his co-workers, on the other hand, tested for dilatation of the pupil only and in 1 of 10 patients they found a contribution from  $C_4$ .  $Th_1$  contributed dilator fibers to the pupil in all patients, while  $Th_2$  failed to do so in 2. In 4 of 10 patients dilatation was obtained on stimulation of the anterior root of  $Th_2$  and 2 of these responded to stimulation of  $Th_1$  as well. Different results were recorded by Hyndman and Wolkin (1942) who, after studying 5 cases, came to the conclusion that no sympathetic fibers supplying the skin structures of the face and the upper extremity leave the first thoracic root in man.

Our own experience goes to show that neither the orthodox view of Foerster and Thomas, nor the recently advanced idea of Hyndman and



Fig. 13. Sweating pattern characteristic for some patients following bilateral removal of  $Th_1$ , indicating complete interruption of sweat fibers to the extremities but no loss of sweating in face, neck and trunk.



Fig. 14. Complete absence of sweating of hand following removal of left second thoracic ganglion.

Wolkin, is entirely correct. We have removed the dorsal sympathetic chain below  $Th_1$  (below the stellate ganglion) in 42 cases, and in 18 cases (43%) thermoregulatory sweating of the face and neck was abolished (Figs. 3, 4, 11 and 12). This would conform to the findings of Hyndman and Wolkin, and confirm the fact that there was no sympathetic outflow from  $Th_1$ . In the remaining 57 per cent the skin structures of the face and neck were not denervated (Figs. 5, 6 and 7) which indicated that in these patients  $Th_2$  was not the highest source of sympathetic outflow. Although there was this difference in the sympathetic supply of the skin in our cases there were no differences in the sympathetic supply of the oculopupillary apparatus. In all patients in whom the sympathetic chain was excised below the stellate ganglion, Horner's syndrome was absent,<sup>1</sup> which indicated that the central connection of the oculopupillary apparatus via  $Th_1$  is constant (Figs. 3 to 7). These findings have been confirmed by direct stimulation during operation (unpublished data). Our own investigations have taught us that sympathetic sweat, piloerector vasocon-

strictor and pupillary fibers supplying the face and neck need not arise from the same segments and that no conclusions can be drawn from the absence or presence of any one as to the functional state of the others. This fact is of particular importance when assessing the recovery of sympathetic activity following sympathectomy. So far no differences between the sympathetic innervation of the left and right side have been found. In fact, the exact symmetry of functional loss was remarkable (Figs. 7, 8, and 12) if one considers the differences often found in the anatomy at operation.

From this description of the sympathetic supply of the face and neck it is apparent that removal of the stellate ganglion (inferior cervical and first thoracic) constitutes in all cases a complete and almost pure preganglionic ramisection for the sympathetic fibers to the head and neck. It results in ipsilateral loss of sweating, loss of vasomotor tone, and Horner's syndrome in all cases. Sectioning of the anterior roots or white rami of both  $Th_1$  and  $Th_2$  will result in complete preganglionic interruption of the sympathetic pathways in about 60 per cent of the cases; in the remaining cases there will be an outflow from  $C_4$ ,  $Th_3$  and  $Th_4$  (Fig. 1).

<sup>1</sup> Although occasionally a slight degree of transient Horner's syndrome obtained in a few cases.

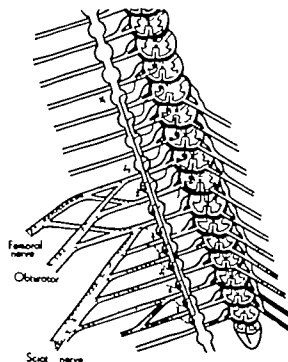


Fig. 5. Sympathetic pathways supplying the lower extremities. The interrupted preganglionic fibers are present in some patients only.

If the cord is sectioned below Th<sub>1</sub> as well 90 per cent of the cases should be completely (preganglionic) sympathetomized and therefore should also show a positive Horner's syndrome. Sectioning of one white ramus alone, either Th<sub>1</sub> or Th<sub>2</sub>, will in all cases interrupt but few of the sympathetic fibers, and no significant functional impairment can be expected. Removal of the second thoracic ganglion does not produce a Horner's syndrome and in 43 per cent of the cases it produced complete preganglionic sympathetomy of the skin structures of the face and neck. In the remaining cases there was no loss of any of the sympathetic functions in the face and neck. In any operation which leaves the preganglionic outflow from Th<sub>1</sub> intact, Horner's syndrome will not occur.

*The sympathetic innervation of the upper extremities*

a. Origin of preganglionic fibers—commonly in the lateral horn of Th<sub>1</sub> to Th<sub>4</sub>, or  $\infty$ , occasionally from Th<sub>5</sub> as well.

b. Course of preganglionic fibers—ascending in sympathetic trunk.

c. Synapses of preganglionic with postganglionic neurons—in inferior cervical and first thoracic ganglion (stellate ganglion) with few syn-

apses in the second and third thoracic and the middle cervical ganglion.<sup>1</sup>

d. Course of postganglionic fibers the vast majority take their origin in the stellate ganglion, a few arise in the ganglia just mentioned, and all join the roots of the brachial plexus.<sup>1</sup>

e. Comment The origin of the preganglionic fibers to the upper limbs is still a matter of considerable dispute and sympathetomy of the hands is still of doubtful permanent value. First, it is interesting to note that the segmental outflow of vasoconstrictor and sudomotor fibers should come from as low as Th<sub>4-5</sub> (Fig. 9). However from the surgical viewpoint the upper level of the outflow is of greater importance. Our present knowledge is largely based on the early experiments of Langley and Bayliss and Bradford. It is precisely here that the application to man of results obtained in animals has been confusing and actually misleading. Kuntz, Alexander and Furculo (1938) demonstrated in cats a sympathetic outflow from Th<sub>1</sub> and suggest the same for man. Sheehan and Marras (1942) could not confirm this in the monkey (Th<sub>1</sub> being the highest spinal outflow) and, as for man, numerous authors, from carefully controlled experiments, have given Th<sub>2</sub> as the upper limit (Foerster 1936 Atlas, 1941 Hyndman and Wolkin 1943 Goets and Marr 1944). Ray *et al.* (1943) had occasion to stimulate the anterior dorsal root in man and found an outflow from Th<sub>1</sub> only in 1 of 11 patients (and in this 1 only on one (left) side, Th<sub>1</sub> having been the highest outflow on the right). Therefore, it appears justified to accept, for the present, Th<sub>2</sub> as the upper limit of the preganglionic sympathetic outflow to the upper extremities in man. The available evidence is summarized in Figure 10.

From all that has gone before, it is clear that removal of the stellate and second thoracic ganglions is a postganglionic sympathetomy. In order to achieve a preganglionic ramisection the stellate ganglion must remain intact and removal of only the second ganglion seems to be the ideal operation, particularly in patients who do not have Kuntz's nerve i.e., no postganglionic fibers arise in the second paravertebral ganglion. This would occur in four-fifths of the cases, but in the other fifth some postganglionic neurons will necessarily be removed with the second thoracic ganglion. The sympathetic fibers of the second

<sup>1</sup>As per cost of his cases Kuntz (1936) found a large branch passing from the second ganglion to the brachial plexus, and Perlew *et al.* (1933) demonstrated Kuntz's nerve in 1 of 21 cases. More recently Kuntz and Kuntz (1942) described a further branch which arose from the third thoracic ganglion, joining the second thoracic nerve central to the origin of Kuntz's nerve and contributing sympathetic fibers to the brachial plexus.

thoracic ganglion however, apparently supply the upper arm only the hand being innervated only by fibers from the stellate ganglion. Indeed, Hyndman and Wolkun (1942), and we ourselves (Goetz and Marr 1944) have suggested removing the second thoracic ganglion only in order to achieve sympathectomy of the upper extremities, and in all cases this has resulted in immediate and complete sympathetic denervation, both as regards sweating (Figs. 11 to 14) and central vasoconstrictor tone. However as Ray *et al* (1943) have shown, an outflow from  $Th_1$  occurs in less than 1 of 10 patients and in these this procedure is therefore not complete. There exists no method of determining such a case beforehand. Therefore, we have recently started to stimulate during operation the cut ends of the sympathetic trunk, the various rami, and the bed from which the sympathetic chain has been removed, and to record the vasomotor responses in the respective limb with our plethysmographic method (Goetz 1946). We thus hope to prove to our satisfaction during operation that the resection carried out is physiologically complete.

It has to be admitted that sympathectomy for the upper extremities has not given the ideal results so easily achieved in the lower limbs. After Kuntz's nerve had been described, the original operation (stellatectomy) was extended to include the second thoracic ganglion (Adson and Brown, 1929). This did not materially alter the situation, and sensitization was then regarded as the cause of the relapses. It was then that Telford (1935) and Smithwick (1936) demonstrated that the arm can be completely denervated by dividing the preganglionic rami of the second and third thoracic ganglia and cutting the sympathetic trunk below the third ganglion (preganglionic ramisection). The immediate results of this operation were far superior to those following stellatectomy. The late results still did not compare favorably with those following denervation of the lower extremities. Regeneration was then held responsible for the late relapses (Simmons and Sheehan, 1939; Smithwick 1940). In order to prevent this, Smithwick recommended intraspinal root section of  $Th_2$  and  $Th_3$  and cutting of the trunk below the third paravertebral ganglion, as well as covering of the phane. Finally the free lower end of the trunk was transplanted into the muscle of the wound (Smithwick 1940). White and Hamlin (1945) recently suggested the use of tantalum instead of the silk cylinder. Even such procedures did not prevent the recurrence of vasoconstrictor tone. The issue has by no means been clarified by a



Fig. 16 Roentgenogram of patient in whom bilateral splanchnicectomy has been performed for hypertension. Note clips fixed by surgeon during operation on all sympathetic fibers cut. Note lowest clip on right side below  $L_2$ , indicating that second lumbar sympathetic ganglion has been removed. On the left side the last clip is above the intervertebral disc between  $L_4$  and  $L_5$  and obviously the second lumbar ganglion has not been removed.

recent report of Skoog<sup>1</sup> who drew attention to sympathetic structures termed 'intermediate ganglia' by Hirt, the significance of which had been overlooked in surgical texts. They are microscopic masses of ganglion cells, distributed without any definite rule in the communicating rami to the spinal nerve, often in closest proximity to the latter. Onodi was the first to mention ganglia in the rami communicantes of human embryos. Van der Broek, and Marinesco and Munez confirmed this, the latter pointing out that they are sympathetic in nature. Hirt found these ganglion cells in certain reptiles and coined the term 'intermediate ganglia.' Rossi, Gruss, and Wreite (1911, 1912, 1913, 1914, 1915, 1916) studied these ganglia in man and in 1941 Wreite pointed out that it is not impossible that these ganglion cells send postganglionic fibers to the nearby spinal nerve, which may escape during standard sympathetic denervation. Skoog working in Wreite's laboratory de-

<sup>1</sup>Reference in this paragraph only are to be found under "Additional References."



scribed these ganglia in more detail in the cervicodorsal region of 5 adults. He, like Wreite, assumes that we are dealing with motor ganglion cells and he visualizes two possible pathways by which they receive their preganglionic supply (1) via the sympathetic trunk, and (2) directly from the spinal nerve next to which they are lying. If the former is true then the significance of the intermediate ganglia is less important from the surgical point of view since removal of the chain will automatically denervate them. However if the latter should be correct, then we would be dealing with entirely intraspinal sympathetic pathways, not accessible to the surgeon by the standard methods employed in interrupting the sympathetic supply. Therefore, the intraspinal sympathetic pathways could easily explain failures following the usual operations. However it is important to realize that the ganglia are also found in the lumbar region (Wreite, 223, 225, 226) where sympathectomy after all, is lasting and complete. This strongly supports the concept that the preganglionic supply to these ganglia reaches them via the chain and not directly from the spinal nerve. However further investigations (particularly physiological) concerning these structures are required before a definite opinion can be formed as to their significance in surgery on the sympathetic nervous system.

In 1943 Geohegan and Aidar suggested that recovery of sympathetic tone may be due to reorganization of function within the sympathetic system itself. They cited a case (Ray *et al.*, 1942) in which the ventral roots from the second to the ninth thoracic segment were sectioned. Complete sympathetic denervation of the hand resulted, but after 10 weeks function returned. The authors pointed out that this could not have been due to regeneration on account of the short time interval and they think that pathways were used which before operation did not carry sympathetic impulses to the hand. They suggest that the first thoracic root which, as we have seen, ordinarily carries no vasoconstrictor fibers to the upper extremities, may develop such function after the usual pathways have been interrupted. They put this theory to the test in cats and found that after interruption of all preganglionic pathways to the forepaw, new pathways developed from higher spinal roots which normally contribute no outflow to the upper extremities. It is quite conceivable how this can happen in a case like the one illustrated in Figs. 5, 6 and 23, but it would be more difficult to conceive in the cases in which the structures of the skin of the face and neck have no origin from  $Th_1$ , the highest outflow being from

$Th_4$  only. In this respect it is interesting that Do Takata (1940) suggested extending the original (postganglionic) cervicodorsal sympathectomy to include the intermediate and inferior cervical as well as the first, second, and third dorsal ganglia. In 16 cases in which he followed this procedure, the results were, in his opinion, comparable with those obtained from lumbar sympathectomy. We are preparing a follow up of our series of cases in which the second thoracic ganglion only was removed. Late relapses occurred in some patients from 10 to 12 months after the initial good result. This may have been due to reorganization in the sense of Geohegan and Aidar. We shall have to put this point to the test by subsequent sectioning of the white ramus supplying the stellate ganglion. For the present we have extended our operation to include resection of  $Th_2$ ,  $Th_3$ , and  $Th_4$  and in some cases we are following De Takata's (1940) suggestion. The results will be communicated in the near future.

In going through the literature it appears to us that many authors do not fully realize that, as we have pointed out on numerous occasions, the sympathectomized vessel still reacts with constriction to the local application of cold. It is only the central vasoconstrictor impulses, as they occur with emotional strain and excitement, which are abolished by sympathectomy. Raynaud's phenomenon, as produced by the local application of cold, may therefore persist following sympathectomy. The vessels will react as well to direct-acting constrictor substances circulating in the blood. If we keep these facts in mind then our hopes of relieving Raynaud's phenomenon by sympathectomy in every case will be less high and our disappointment less acute.

*The sympathetic supply to the thoracic and abdominal wall.* This may be quickly disposed of since it is of little clinical importance. The preganglionic fibers arise in the lateral horn of the corresponding segments and reach the paravertebral ganglia where the synapsis of the postganglionic fibers is to be found. The neurons of the latter join the spinal nerves, as is the rule for somatic areas. It appears, therefore, that we have a strictly segmental distribution.

*The sympathetic supply to the lower extremities*  
a. Origin of the preganglionic fibers—in the lateral horn of  $Th_8$  to  $L_4$  (a)

b. Course of the preganglionic fibers—descending in the sympathetic trunk.

c. Synapsis of preganglionic with postganglionic neurons—in  $L_4$  to  $S_2$  for the foot and the lower leg, and in the ganglia of  $L_1$  to  $L_4$  for the thigh and medial aspect of the lower limb.

d. The postganglionic fibers take their origin in the ganglia corresponding to the lumbosacral plexus, i.e.  $L_4$  to  $S_3$  for the sympathetic fibers joining the sciatic nerve, and  $L_1$  to  $L_4$  for the fibers joining the femoral and the obturator nerve.

e. Comment As a rule the lowest preganglionic sympathetic outflow is via the anterior root of  $L_4$  and all lower sympathetic ganglia receive their preganglionic supply via the second lumbar ganglion (Fig 15). The second ganglion therefore holds a key position and its removal results in complete interruption of the sympathetic pathways to all the lower ganglia and, hence, complete sympathectomy of the foot. This is well illustrated by Figures 16 and 17 obtained from a patient who elsewhere underwent transdiaphragmatic splanchnicectomy for hypertension. The clips fixed by the surgeon (Fig 16) indicate that on the right side  $L_4$  was removed, but on the left side the first lumbar ganglion only was resected. Clinically the right leg only was sympathectomized and plethysmographic examination (Fig 17) indicates complete ablation of central vasomotor control on the right and normal sympathetic activity on the left. Incidentally this clearly demonstrates the importance stressed previously (Goetz 1947) of checking every case of splanchnicectomy as to the completeness of the operation.

Since, however in a small number of cases there is some outflow from  $L_4$  (vide p 423), the standard lumbar sympathectomy for cases of vascular deficiency in the foot and lower leg is removal of the second and third lumbar ganglia which is automatically preganglionic in type (Fig 15) and presents no problems. At Groote Schuur Hospital we do not consider lumbar sympathectomy a serious major operation and it is efficiently carried out by the general surgical staff by means of the extrapertoneal approach on both sides in a one-stage operation. None of the postganglionic fibers is interrupted. They take origin from  $L_4$  downward. Some surgeons remove  $L_4$  as well which as the chart illustrates, is not only unnecessary but it should remain untouched.<sup>1</sup> As for  $L_1$  its removal bilaterally in the male will cause sterility through paralysis of the ejaculatory mechanism. No untoward effects have been recorded in the female. Removal of  $L_1$  and  $L_4$  usually causes loss of sympathetic activity from the knee downward. When  $L_1$  is left intact, an area on the inner aspect of the lower limb to just above the ankle, corresponding to the saphenous

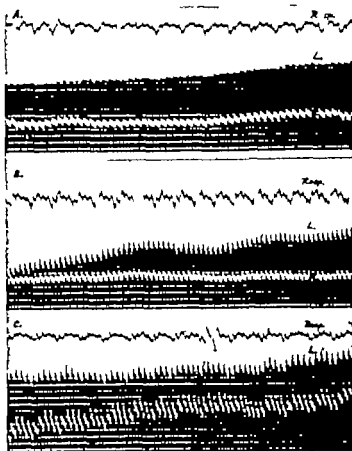


Fig 17 Plethysmographic tracing of the blood flow simultaneously recorded in the two lower extremities of the same patient as in Figure 16. A Blood flow during rest. Upper record—left lower record—right big toe. Resp = respiration. Note pulse volume in the left limb is slightly smaller than in the right one. B Thirty minutes later following body heating. No increase in pulse volume of the right limb (lower record) but marked increase in the pulse volume of the left limb (upper record) indicating release of the vasoconstrictor tone in the latter. C Following local application of heat to the right limb. Note the increase in pulse volume of the right limb, indicating that there is no organic vascular disease present and that the failure to dilate in B was due to interruption of the sympathetic pathways.

nerve arising from the femoral nerve can be mapped out in some cases in which sympathetic control has not been abolished (Figs. 18 to 19). Therefore, we recommend removal of  $L_1$  in the cases in which the question of sterility does not concern the patient. In cases in which the release of vasoconstrictor tone well above the knee has to be aimed at, it is always advisable to remove  $L_1$ . We have however to point out that removal of  $L_1$  to  $L_4$  constitutes a postganglionic sympathectomy for the sympathetic fibers joining the femoral and obturator nerves. So far well over 200 lumbar sympathectomies have been carried out at Groote Schuur Hospital. In each,  $L_3$  and  $L_4$  and occasionally  $L_1$  have been removed. In all cases a complete sympathectomy has been achieved and

<sup>1</sup>The arrangement of the ganglia in the lumbar region varies. Great deal, the ganglia fusing with each other often in complex fashion, and leading to duplication of the intervening trunk, so that recognition of the individual ganglion is often impossible (Perlow and Vehe, 935; Pick and Stebbins, 946).

is still complete in the patients operated on as long as from 10 to 15 years ago. Reflex vasomotor activity has not recurred in a single case! It appears obvious, therefore, that removal of  $L_4$  in order to prevent regeneration is not justified, removal of  $L_4$  and  $L_5$  being entirely sufficient. Interlumbosacral sympathectomy a procedure recommended by Danilewicz *et al.* (1933) which consists in sectioning the chain below  $L_4$ , is not to be recommended for reasons obvious from Figure 15.

*The sympathetic innervation of the organs in the thorax (in particular of the heart)*

a. Origin of the preganglionic fibers—in the lateral horn of  $Th_1$  to  $Th_{11}$  on

b. Course of the preganglionic fibers—part of the fibers arising in  $Th_{1-3}$  ascend to the cervical ganglia, most of the fibers go to the corresponding paravertebral ganglia.

c. Synapsis of preganglionic with postganglionic neurons—in the three cervical ganglia and the upper five thoracic ganglia.

d. Course of the postganglionic fibers—they arise in the three cervical ganglia and form the three cardiac nerves to reach the cardiac plexus. In addition, there are direct fibers from the paravertebral ganglia to the cardiac plexus.

e. Comment. Surgery of the heart hardly ever calls for interruption of the sympathetic motor fibers, and the surgeon's interest centers around the sensory pathways which join the sympathetic system. Although this article does not deal with the sensory pathways, we cannot fail to mention here surgical procedures on the sympathetic system adopted in the treatment of pain in coronary disease. Certain authors still hold (Reid and Andrus, 1944) that all sensory fibers of the heart can be interrupted by excision of the stellate ganglion. This is definitely not so. The pathways for cardiac pain are essentially the same as those just traced for the motor cardiac fibers (Ionescu *et al.* 1928, White *et al.*, 1933, McEachern *et al.* 1940, Kuntz and Morehouse, 1930). Some fibers ascend via the middle and lower cardiac nerve to the middle cervical and the stellate ganglia and thereafter descend to the upper three thoracic ganglia to reach the cord via the corresponding white rami and posterior roots (Fig. 21). Twice as many fibers, however, run across the posterior mediastinum to reach the upper four to five, possibly six to seven (Saccomanno 1943) thoracic ganglia directly which they pass without interruption to proceed via the white rami to the posterior root ganglia. The superior cardiac nerve apparently does not conduct cardiac pain. Hence, the surgical approach must be either at the thoracic ganglia (White, 1944) or at the white rami (Raney

1939) or alternatively at the posterior roots (Davis, 1933). The latter has the advantage that there is no interference with efferent fibers.

François Franck (1899) was the first to suggest sympathectomy for angina pectoris, and Jonnesco (1920) was the first to carry out the operation in 1916. He removed the entire cervical sympathetic chain, including the stellate ganglion, bilaterally. In the following years this operation was carried out by numerous surgeons who reported good results (Coffey and Brown, 1923, Brown, 1923, Bacon, 1923, Bruening, 1923 and Cutler, 1932). Kerr (1936) reported complete relief of pain in 14 of 30 patients operated on in this manner and Leriche in 1936 advocated stellatectomy for the same purpose. The good results claimed for these procedures are difficult to explain in the light of recent anatomic and physiologic findings. Indeed, Learmonth (1937) and Ochsner and DeBakey (1937) report a large number of failures from cervicothoracic sympathectomy because of the failure to interrupt the direct afferent fibers.

The ideal procedure is obviously resection of the upper four or five posterior roots, which gives consistent relief from coronary pain (Davis, 1933, Haven and King, 1942, Ray 1943). The effectiveness of resection of the upper three thoracic sympathetic ganglia, through which most of the sensory axons run, has been found by White and Smithwick (1941) and White (1944) to approach 100 per cent. In patients who are good enough operative risks there is no evidence that relief from pain has any but a favorable effect. While severe constricting pain which radiates to the precordium and inner arm disappears consistently following the destruction of these pathways, other nonpainful sensations persist, such as a sense of fullness in the upper end of the sternum, vasomotor changes in the face and the neck, palpitations, and dyspnea. Such residual sensations afford an adequate warning signal to the patient, indicating that he is straining his heart. There is evidence that these nonpainful impulses are probably transmitted over the vagus.

Unfortunately the selection of patients who are good enough operative risks to withstand the procedure is not easy and many of the worst sufferers have too poor a coronary circulation to withstand an operation of this nature. In these the alcohol injection into the paravertebral ganglia, as advocated by Mandl (1925) has been the solution (White and White, 1928, Levy and Moore, 1941, White, 1940 [1941], Perlow 1942). As White (1944) has pointed out, interruption of the pathways of pain may have a beneficial effect on the coronary circulation as well.



Fig. 18.



Fig. 19.

Fig. 18. Typical sweat pattern following removal of the left second and third lumbar ganglia. Note sweating on the inner aspect of the left leg extending down to the ankle.

Fig. 19. Same patient as in Figure 18. Outer aspect of left leg. Note complete absence of sweating of foot.

*The sympathetic supply to the abdominal viscera.*

a. Origin of the preganglionic fibers—in the lateral horn of  $Th_{(4,5)}$  to  $L_2$

b. Course of the preganglionic fibers—they pass through the corresponding paravertebral ganglia to form the three splanchnic nerves. The fibers from  $L_1$  and  $L_2$  reach the aorticorenal plexus directly (Fig. 22)

c. Synapsis of the preganglionic with the postganglionic neurons—in the solar plexus (celiac, superior mesenteric, and aorticorenal ganglia)

d. Course of the postganglionic fibers—they form a plexus around the main blood vessels which they join to reach the various organs.

e. Comment. The solar (celiac) plexus is the large nerve mass on each side of the celiac axis continuous with a network of sympathetic nerves in relation to the aorta. Bichat (1802) considered that the solar plexus constituted the termination of the two great splanchnic nerves. However it is known that the solar plexus receives not only gray and white fibers from the thoracic sympathetic, but also fibers from the lumbar sympathetic, the right vagus, and perhaps from the phrenic nerve (Hovelacque, 1927). The solar plexus comprises a dense meshwork of fibers with aggregates of a number of secondary ganglia in relation to the branches of the aorta. The classic description supposes that there are six well formed individual ganglia, the semilunar (celiac) ganglia, the aor-

ticoarenal ganglia, and the superior mesenteric ganglia. It must be realized, however that this is only a schematic representation and that the ganglia fuse and split up into many variations which it is not possible to describe in this article.

The sympathetic innervation of the suprarenal gland is also preganglionic in origin, being supplied via the splanchnic and directly from  $L_1$  and  $L_2$  (Elliot, 1913; Hoshi, 1926; Hollinshead, 1936). The preganglionic fibers end in relation to the secretory cells in the medulla. The latter are therefore morphologically comparable to the postganglionic neurons in the paravertebral ganglia. The most convincing evidence to this effect has recently been furnished by Hammond and Yntema (1947). After removal of the neural crest in chick embryos, sympathetic neurons in the paravertebral ganglion chain and the chromaffin cells of the suprarenal medulla were absent.

The splanchnic nerves have gained considerable prominence within recent years on account of the surgical treatment of hypertension, which aims at sympathetic denervation of the splanchnic area.

We know that the splanchnic bed is man's mechanism for maintaining his blood pressure level relatively constant in the lying, sitting, and standing positions. If the splanchnic is well denervated, the blood pressure level should fall as the patient changes from the lying to the sitting and standing positions. Indeed, such a change has

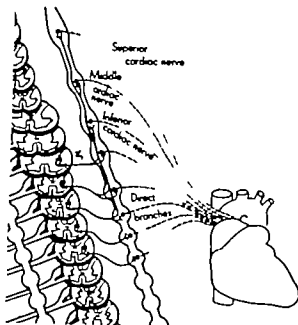


Fig. 30 Efferent sympathetic cardiac pathways.

followed splanchnic resection by laminectomy and anterior root section, although this operation, in addition to interrupting the sympathetic motor pathways, also divides somatic motor nerve fibers. The latter results in extensive muscular paralysis of the abdominal wall.

Several operations have been employed, connected with the names of Pieri (1927) Craig (1934) Adson and Brown (1934) Peet (1935) and Crile (1938). The operation practiced by most surgeons is that devised by Smithwick (1940).

The operative technique should comply with the three cardinal points, viz., it should (1) be anatomically complete (*vide* p. 425) (2) be preganglionic in type, and (3) safeguard against future regeneration. Smithwick suggested transdiaphragmatic removal of the ganglionic chain extending from  $T_4$  down to  $L_2$  and extirpation of a long segment of the greater lesser and least splanchnic nerves, the celiac ganglion to be left intact. Such an operation is followed by postural hypotension, but unless a postural change in blood pressure follows splanchnic resection, it is not certain that the maximum change in blood pressure has been produced. Thorough denervation of the splanchnic bed and removal of the lumbar chain also give a reasonable guarantee that the kidneys and the adrenal glands are denervated as well.

During the operation the kidneys, adrenal glands, and the paravertebral regions should be

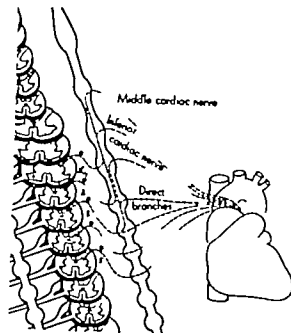


Fig. 31 Diagram of afferent (pain) cardiac sympathetic fibers. Not direct branches and absence of pathway via superior cervical ganglion.

carefully explored in order to obtain all possible information regarding renal pathology and to exclude adrenal tumors and paragangliomas.

In discussing the surgical treatment of hypertension, Grimson (1942) states that the fall in blood pressure has been directly proportional to the extent of the sympathectomy and inversely proportional to the severity of the disease. He therefore advocates total sympathectomy which, as he points out (Grimson, Wilson, and Phemister 1937) also prevents neurogenic elevation of the blood pressure as produced by increase in the intracranial pressure. We (Goetz, 1947) have pointed out that the operative procedure suggested by Smithwick does not fulfill the first prerequisite for successful operation, i.e., it is not anatomically complete in that sympathetic pathways from the dorsal ganglia above  $T_4$ , forming the preaortic and esophageal plexus, are not interrupted. As we have pointed out earlier these plexuses link up with the solar plexus and, we may add, the phrenic nerve which receives its sympathetic supply from the superior cervical ganglion, has been found to send connections to the celiac ganglion. We have drawn attention to the possibility that the body may re-establish sympathetic control of the splanchnic area in this roundabout way (Goetz, 1947) and we felt that such reorganization, rather than regeneration, may account for

the failures in some cases following the Smithwick operation. From the experiments of Geohagan and Audar (1942) we know that in other regions such re-organization is the rule rather than the exception. There is, therefore, strong evidence in favor of carrying out a more extensive procedure than has originally been suggested by Smithwick, and at Groote Schuur Hospital we aim at total sympathectomy through an incision removing the tenth and part of the ninth rib the sympathetic chain being at present removed from  $D_4$  to  $L_2$  in tact with its connections forming the splanchnic nerves and the direct branches to the organs in the mediastinum and the heart (Fig. 23).

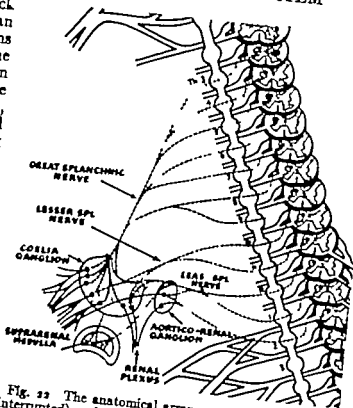


Fig. 23 The anatomical arrangement of preganglionic (interrupted) and postganglionic (uninterrupted) sympathetic pathways to the splanchnic bed.

cardiac failure and cerebral accidents, then the importance of this operation cannot be overestimated.

#### CONCLUDING REMARKS

Cannon and his coworkers (1929) and McDonough (1939) have demonstrated that an intact sympathetic nervous system is not a *sine qua non* in a protected and constant environment, and totally sympathectomized cats and dogs may thrive under such conditions. The stresses and strains which are met with in the normal existence however make its integrity essential. According to Cannon, whose views have been extremely well expressed by White, we should think of the sympathetic nervous system as an emergency protective mechanism which is not functioning all the time but which is always ready to go into action to combat any variety of adverse circumstance either in the surroundings or in the internal machinery. This co-ordination of the body as a whole to meet changing conditions in its internal and external environment by autonomic adjustment has been called 'homeostasis' by Cannon. Homeostasis frees the individual from the difficult task of paying routine attention to the management of the details of bare existence. Without homeostatic control, the warmblooded animal would be in constant danger of disaster unless always on the alert to correct voluntarily

Those who had expected the Smithwick operation to be a cure all for hypertension must be sadly disappointed. It is obvious that when cardiac and renal function are both significantly impaired, no operation can be successful. Everyone who has had reasonably wide experience with the operation, however, will admit that in some cases it has produced a permanent fall in the blood pressure which for all practical purposes constitutes a cure. Regression of eyeground changes, decrease in the size of the heart, improvement in the electrocardiogram, increase in the renal function, and relief of the symptoms are noted in many cases. The difficulty still arises in selecting the correct patients for operation out of the number of potential candidates. Smithwick (1944) has published his grading criteria, yet our own experience has shown that they are not as helpful as suggested by him in predicting the ultimate results of the operation. Some patients, who should have responded well according to these criteria, benefited very little or not at all from the operation, while others, on whom the operation appeared to be misplaced gave good responses. It is to be hoped that it will eventually be possible to define the indications for the operation more clearly so that a higher percentage of patients will be benefited by the operation as judged by a persistent and significant fall in the blood pressure. Although it is not yet established that the results will be permanent, at least there is good reason to believe that the hands of the clock can be set back for a number of years in the majority of younger patients with hypertension who have not been permitted to progress to the stage of advanced degenerative changes in the arteries of the kidneys, heart, and brain (White 1944). If it is realized that it is very rare for the increased blood pressure to return spontaneously to normal values, for any length of time and that a large majority of patients with hypertension die at a relatively early age of the sequelae of hypertension, such as

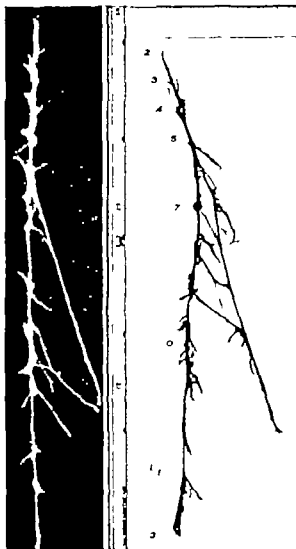


Fig. 23. Two typical specimens of the sympathetic chain and splanchnic nerves as removed by subtotal sympathectomy at Groote Schuur Hospital for hypertension.

what the sympathetic nervous system regulates in a purely automatic fashion.

Some of the most common conditions which arouse sympathetic activity are pain, emotional excitement, extremes of temperature, asphyxia, hemorrhage, strong muscular exercise, dehydration, and hypoglycemia. Furthermore, any form of intense emotion or psychic trauma stimulates a generalized sympathoadrenal discharge. It is such conditions which cause particular strain on the vascular system of patients already suffering from hypertension or from structural vascular disease. On the other hand, we must not lose sight of the fact that the autonomic nervous sys-

tem is not a purely motor system under control of higher centers, but that sensory impulses arising in smooth muscle, ligaments, joints, and glandular tissue, control, to a large extent, sympathetic motor activity in a purely segmental reflex fashion. The indications for sympathectomy then, are to be found among such conditions in which there is either a central or peripheral disturbance of the reflex proprioceptive regulatory function of the sympathetic nervous system. Man, being capable of protecting himself against adverse circumstances and of creating a constant environment for himself can fortunately continue to exist after a large portion, or even the whole, of the sympathetic chain has been removed.

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# ABSTRACTS OF CURRENT LITERATURE

## SURGERY OF THE HEAD AND NECK

### ETE

**Parathyroid Deficiency** DONALD J. LYLE. *Am. J. Ophth.*, 44, 3, 580.

The ocular syndrome of cataract and papilledema is rare as only 11 cases have been reported in the world literature. The cataract produced by parathyroid deficiency, however, is of relatively frequent occurrence. Parathyroid deficiency may be idiopathic, as the result of lack of growth or degeneration of the glands, or as a result of operation. At a latent stage, the symptoms of hyperneuromuscular excitability are present only upon local nerve stimulation or irritation. At a manifest stage the deficiency is characterized by generalized spontaneous convulsions, in addition to ectodermal changes. The neuroectodermal symptoms, i.e. mental disturbances, and increased intracranial and cerebrospinal pressures with papilledema, appear.

The diagnosis of parathyroid deficiency is made by means of the laboratory tests of the blood calcium and phosphorus, added to the signs of excessive neuromuscular irritability. The normal calcium content of the blood varies within the limits of 9 and 11 mgm. per 100 c.c. In cataract tetany or parathyroid deficiency the level drops to 7 or 8, and in manifest tetany as low as 4. The phosphorus content, which is normally between 2 and 4 mgm. is relatively or absolutely increased in proportion to the calcium content. A differential diagnosis must be made from idiopathic epilepsy and brain tumor.

The case of a 53 year-old woman, who was examined because of failing vision, is reported. Years previously she had undergone a thyroidectomy. Since then, she lost her hair, her skin was dry and her nails were brittle. Her corrected visual acuity was reduced to 20/100 in the right eye and 20/40 in the left eye. Diffuse posterior subcortical opacities were found in the lenses, and the fundi were normal. There was a slight elevation of the intraocular pressure. On the basis of the presence of the positive Chvostek and Trousseau signs, a low blood calcium (8.1 mgm. per 100 c.c.) and the history, a tentative diagnosis of postoperative parathyroid deficiency was made. During the 3 years following, the lense opacity increased to a mature cataract. The intraocular pressure fluctuated, apparently rising with the reduction of calcium and falling when the calcium returned to a normal level. After a cataract extraction in the right eye, a cyclodialysis operation became necessary later some permanent central corneal opacities developed. An uneventful cataract operation was performed upon the left eye. On the ninth day, however, the patient developed a generalized convulsion lasting 4 minutes and preceded

by a loud, piercing scream. From the anamnesis, it was found that the patient had had six similar seizures in the last 5 months. On postoperative examination the patient seemed quite confused, disturbed, and blind. The ophthalmoscopic examination revealed clear media but a papilledema of considerable amount, with parapapillary venous engorgement without hemorrhages. The visual fields were markedly constricted. Roentgenograms of the skull, orbit, and intracranial contents were normal. Immediate improvement began with the administration of dihydrotachysterol and calcium lactate. Convulsions and twitchings ceased after the first day. The mentality cleared. The visual fields improved and the papilledema, though still present, seemed to be reduced considerably at the end of the first week.

MICHEL LOUTVALLAN, M.D.

**Pterygium.** EMANUEL ROSEN. *Brit. J. Ophth.*, 1944, 3, 300.

A new technique for pterygium surgery is described and illustrated. The pterygium is excised from the cornea with a sharp knife and folded back underneath itself to be sutured under the caruncle. The conjunctiva is closed, horizontally from the boggled end of the pterygium to the limbus.

The advantages offered are

1. The head of the pterygium is brought into contact with the caruncle which is a modified cutaneous structure.
2. The direction of the growth of the pterygium is completely reversed.
3. The episcleral tissue fuses with the episcleral tissue.
4. The pterygium is completely buried.

EARL H. MILES, M.D.

**Obliteration of the Central Artery of the Retina—Partial Recuperation of Vision and Retinographic Appearance** (Obliteración de la arteria central de la retina. Recuperación parcial de la visión y aspectos retinográficos). J. LUIS PAVIA and MAURICIO LEE. *Rev. de neuro-oftal. cir. Neur.* 1947, 17, 97.

The authors state that obliteration of the central artery of the retina has been attributed to many causes, and they review the works of the various authors to date who have attributed obliteration of the retinal central artery to embolism or thrombosis. To these two factors the authors wish to add the factor of angiospasm which is becoming of increasing importance.

The authors think that in patients more than 60 years of age thrombosis and embolism prevail. In those between 55 and 60 years old the principal factor is angiospasm.

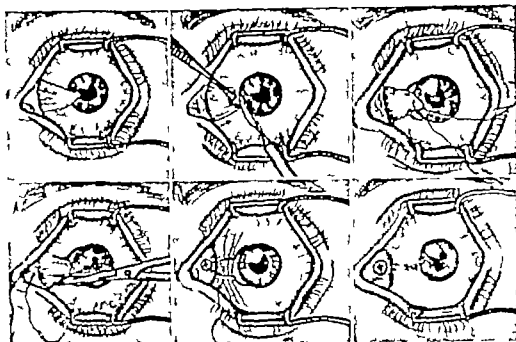


Fig 1 (Rosen) This is a diagrammatic representation of the various steps in the operation for pterygium. a, Characteristic pterygium before operation. b Pterygium being severed from the cornea and dissected back to its base. c, Double armed suture placed through pterygium head and emerging from the episcleral side. A small area of conjunctiva is undermined at each limbal area and appears like a small crescent. d Each arm of the suture is passed underneath the pterygium and brought out through the caruncle. The pterygium is separated from the sclera with the scissors at its upper and lower borders. e, The double armed suture is tied over a small rubber button. The upper and lower free edges of the conjunctiva are sutured with three or four single sutures. f The conjunctiva is completely approximated.

Two cases recently studied by the authors are reported. In one of these the authors followed the characteristic changes of the retina with excellent retinographic photographs until the retina slowly returned to normal.

The authors conclude that the essential factor upon which the nutrition of the retina depends is the choroecapillary circulation which may or may not be sufficient to conserve the vision. The result therefore may be intense anemia of the internal layers which may result in loss of transparency and complete atrophy.

W. FOSTER MONTGOMERY M.D.

## EAR

A Contribution to the Question of Otitis Media in Infants. ANDRÉ MARIE. *J. Lar. Otol. Lond.* 1948 62 207.

The author states that it is generally acknowledged that infants during the first year of life are more susceptible to otitis media for two reasons: (1) the greater susceptibility of the infant to infection; (2) the anatomical peculiarities of the infant middle ear: (a) the relatively short wide almost horizontal eustachian tube and (b) the remnants of embryonic middle ear mucosa.

Otitis media in infants is classified as follows: (1) Witmaack's otitis media praetoratum, (2) catarrhal and suppurative otitis media. (a) manifest or latent

and (b) primary or secondary to any concurrent infection elsewhere.

The relationship between infection of the gastrointestinal system and otitis is considered reference being made to I. E. Ebbs who found that of 238 infants with gastroenteritis, 81 per cent also displayed otitis. In the symptomatology of otitis media in infants weight loss and gastrointestinal infection are more prominent symptoms and pain in the ear a less prominent symptom of otitis than in older children and adults.

The author attempts to show that the appearance of the ear drum if carefully examined is a reliable guide in making a diagnosis of otitis media in infants and believes there is general agreement that myringotomy should be performed in all cases of obvious or doubtful disease of the tympanic membrane.

One hundred and one cases of suspected otitis media in infants under 1 year of age are surveyed. When otoscopy revealed the slightest deviation from normal myringotomy was done (in 92%) and a diagnosis of otitis media was made in 79 cases (78.2%). In 19.9 per cent of the 79 infants mastoidectomy was performed with a mortality rate of 27 per cent.

The average amount of time required for treatment of the infants with uncomplicated disease was 24 days; the time required for treatment of those with complications was 53½ weeks.

The dosage, or incidence of use of penicillin and sulfonamide drugs in the treatment of otitis media in infants is not clearly given; however the author states that the results were rather less effective and very slow as compared to the results in older children. He believes this may indicate that many of these cases are secondary complications of gastro-enteritis. The findings in each case are tabulated.

JOHN J. BALLINGER, M.D.

**The Surgery of Otosclerosis (La chirurgie de l'otospongiose)** RAYMOND PHILIP J. *med. Bordeaux* 948, 5-63.

The author presents his method of fenestration for the treatment of deafness due to otosclerosis.

The disease process itself is considered as evolving in three periods:

1. A period of invasion of the capsule when treatment is primarily medical.
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The second period is the surgical phase of the illness in the course of which 80 per cent of those operated upon can recuperate sufficient hearing for normal conversation. Surgical treatment in creating a fistula and new tympanic system better the hearing and also seems to arrest the evolution of the disease.

The operative technique is described in detail and the complications and end-results are discussed.

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**The Fenestration Operation** E. R. GARNETT PAXE. *Irish J. M. Sc.* 1948, Ser. 6, 45.

The author reports his experiences with the fenestration operation in more than 600 cases. With regards to the selection of cases for operation, Garnett Paxe classifies cases of clinical otosclerosis into three groups in each of which a certain result may be expected.

Group I consists of cases in which the reserve of cochlear nerve function is adequate. The prognosis in this group is that from 80 to 90 per cent of the patients will have restoration of hearing to the practical hearing level.

Group 2 consists of the borderline cases, which show cochlear nerve damage to such an apparent extent that maximum improvement is necessary to obtain a practical hearing level. Success in this group is anticipated in only about 20 to 40 per cent of the cases.

Group 3 consists of the cases with the cochlear nerve so far deteriorated that the chance of improvement from fenestration is practically nil. The author considers paracusis willisiana a sign which should be carefully observed before a patient is selected as suitable for the operation. This is a questionable factor because patients are not always reliable in reporting or recollecting this phenomenon.

In reporting his operative procedure the author emphasizes that hemorrhage must not be allowed to occur and trauma to all tissues must be kept to a minimum. Pentothal anesthesia after heavy premedication is preferred by the author with novocain and adrenaline injected into the site of incision. Magnification is obtained by using the binocular loupe microscope and constant irrigation is employed to wash away bone dust and to keep the field clear of blood. The author states that he uses his own modification of Shambaugh's enchondralized fenestra, which is much longer than either Lempert's or Shambaugh's, and more of the endosteal bone is exposed. The author describes his technique of extensive removal of the periosteal bone which leaves only a thin eggshell layer of the endosteal bone extending posteriorly from the anterior end of the dome of the vestibule over the ampulla and a downward bend of the lateral semicircular canal to the posterior canal.

Garnett Paxe states that he has given up the use of the cartilage stopple and is at present working with solutions of antihistamine agents in an attempt to decrease postoperative labyrinthitis but he does not describe the technique of their use.

The author's experience regarding relief of tinnitus by the operation leads him to expect marked or complete relief in approximately 25 per cent of his cases.

He reports on 100 cases of stopple insertion in which operation was done 2 years previously.

Hearing improved and improvement was maintained in 51 per cent.

#### CRITERIA FOR GROUPING

	Air Conduction	Bone Conduction (Meaning)	Range	Normal and Middle Ear and Present Vestibular Status	Paracusis Willis	Age
Group I	Not below 20 decibel loss up to 2025	Not below 20 decibel (or 21 20 decibel for 1925 20 decibel for 2025)	-vs for facts from 20-2025	Excellent	++	Best results 15 to 25, but may operate at any reasonable age
Group II	Not below 20 decibel loss up to 1925	Not below 20 decibel loss for 21 25 decibel loss for 1925 25 decibel loss for 2025	-vs all facts from 20 to 2025 2025 usually not heard	May have had former Ch. S.O.M.	++	Usually 25-40
Group III	May have 20% deafness at any frequency	Usually 20 and 25 are heard	-vs for 20 and 25	May or (may not) be present	+ or -	Usually elderly though occasionally in early twenties

Hearing improved and the improvement was lost later in 39 per cent.

Hearing was not improved in 7 per cent.

Hearing became worse in 3 per cent.

The degree of improvement is not specified nor is the final hearing level attained by the patient mentioned.

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Group 3 In 3 cases no improvement was noted. In the latter series the author has not had a case in which the fistula has completely closed as judged by the fistula sign on probing.

The author emphasizes the importance of detailed follow through records of the operative technique together with standardized audiometric records to all surgeons actively engaged in the fenestration operation.

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The authors present 12 cases illustrating infections: mucocoeles, epidermoid cysts and osteomas of the paranasal sinuses responsible for complications of the orbit. The intimate anatomical relationship between the sinuses and the orbit allows for ready involvement of the orbital contents by inflammatory and other lesions of the sinuses.

The diagnostic problem involved in the orbital complications depends upon a consideration of the symptomatology as follows:

1. The symptoms of inflammatory changes in the orbit such as (a) inflammatory edema of the eyelids (b) subperiosteal abscess, a collection of pus between the bony wall and the periorbita, (c) orbital abscess (d) orbital cellulitis and (e) cavernous sinus thrombosis of the anterior or orbital type.

2. The symptoms of disturbances from mechanical causes due to encroachment upon the capacity of the orbit by mucocoeles, pyoceles, chronic hyperplastic sinusitis, cysts and neoplasms and manifested by displacement and disturbance in the mobility of the globe, injury to the optic nerve, changes in refraction and disturbance in the drainage of tears.

3. The orbital apex or sphenoid fissure syndrome, a syndrome consisting of ptosis, complete ophthalmoplegia, impaired vision and pain corresponding to the ophthalmic division of the fifth nerve which is caused by affection of the vessels and nerves which pass through the superior orbital fissure and the optic foramen.

The authors found in their study that difficulty and delay in diagnosis arose because (1) the sinus

infection was not apparent from symptoms or rhinologic examination (2) a noninflammatory lesion was obscured by inflammatory reaction (3) in spite of a history of sinus infection the focus was elsewhere and (4) lesions of the sinuses such as mucocoeles or osteomas gave no nasal symptoms and encroachment on the orbit so gradually that eye symptoms were not manifest until the involvement became marked.

The authors believe that roentgen examination was the greatest single aid in the diagnosis but it must be correlated with the clinical evidence.

As for treatment, inflammatory conditions causing orbital infections are most efficaciously treated with penicillin in adequate dosage given parenterally which largely obviates the previously practiced surgical procedures. As for the lesions which cause disturbances by mechanical means the authors advocate surgical incision and drainage through the sinuses into the nose in cases of mucocoeles and hyperplastic lesions or surgical removal of neoplastic lesions such as osteomas, followed by the establishment of adequate nasal drainage.

In illustrating the problems of diagnosis and therapy the authors reviewed the case histories of (1) 6 cases of the inflammatory group (2) 3 cases of mucocoeles, (3) 1 case of epidermoid cyst of the frontal bone, and (4) 2 cases of osteoma of the frontal and ethmoid sinuses.

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This article concerns the report of 3 cases of oral disease which represent very dramatic examples of the importance of co-operation between dental, medical and surgical services for proper diagnosis and treatment of diseases the first symptoms of which may occur within the oral cavity. The neglect of a complete physical examination in such cases may cause very embarrassing results.

The first case was that of tumor of the maxilla associated with hypoparathyroidism. This case was that of a 62 year-old farmer who was referred to the dental clinic for treatment of a firm, nontender, asymptomatic swelling of the left side of the face of 3 weeks duration. This tumor involved the anterior portion of the left alveolar process and caused the left cheek to bulge. It had increased progressively for 3 weeks. The patient was referred by the dental clinic to the laboratory for blood studies after a biopsy of the lesion which came back as a giant-cell

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#### CRITERIA FOR GROUPING

	Air Conduction	Bone Conduction Masking	Rinne	Normal and Middle Ear and Eustachian Tubes	Paroxysmal Vertigo	Age
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Group II	Not below 30 decibels up to 1024	Not below 30 decibels for 512 35 decibels for 1024 45 decibels for 2048	++ all levels from 256 to 2048 usually not heard	May have had former Ch. S.O.M.	++	Usually 22-40
Group III	May have 100% decrease at any frequency	Usually 30 and 5 are heard	++ for 30 and 512	May or (may not) be present	+ or -	Usually elderly though occasionally in early twenties

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Group III	May have 50% deafness at any frequency	Usually 50 and 256 are heard	-+ for 256 and 512	May or (may not) be present	+ or -	Usually elderly though occasionally in early twenties

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Group 2 consists of the borderline cases, which show cochlear nerve damage to such an apparent extent that maximum improvement is necessary to obtain a practical hearing level. Success in this group is anticipated in only about 20 to 40 per cent of the cases.

Group 3 consists of the cases with the cochlear nerve so far deteriorated that the chance of improvement from fenestration is practically nil. The author considers paracusis willisiana a sign which should be carefully observed before a patient is selected as suitable for the operation. This is a questionable factor because patients are not always reliable in reporting or recollecting this phenomenon.

In reporting his operative procedure the author emphasizes that hemorrhage must not be allowed to occur and trauma to all tissues must be kept to a minimum. Pentothal anesthesia after heavy premedication is preferred by the author with novocain and adrenaline injected into the site of incision. Magnification is obtained by using the binocular loupe microscope and constant irrigation is employed to wash away bone dust and to keep the field clear of blood. The author states that he uses his own modification of Shambaugh's encondralized fenestra, which is much longer than either Lempert's or Shambaugh's, and more of the endosteal bone is exposed. The author describes his technique of extensive removal of the periosteal bone which leaves only a thin eggshell layer of the endosteal bone extending posteriorly from the anterior end of the dome of the vestibule over the ampulla and a downward bend of the lateral semicircular canal to the posterior canal.

Garnett Paise states that he has given up the use of the cartilage stopple and is at present working with solutions of antihistamine agents in an attempt to decrease postoperative labyrinthitis, but he does not describe the technique of their use.

The author's experience regarding relief of tinnitus by the operation leads him to expect marked or complete relief in approximately 25 per cent of his cases.

He reports on 100 cases of stopple insertion in which operation was done 3 years previously.

Hearing improved and improvement was maintained in 51 per cent.

CRITERIA FOR GROUPING

	Air Conduction	Bone Conduction Masking	Range	Normal and Modified Ear and Foreign Ear-Cochlear Tubes	Paracusis Willisiana	Age
Group I	Not below 40 decibels up to 102.5	Not below 40 decibels (up to 102.5) 40 decibels for 102.5	-40 for 102.5 (from 102.5-104.5)	Excellent	++	Best results 20 to 25, but may operate at any reasonable age
Group II	Not below 40 decibels up to 102.5	Not below 40 decibels (up to 102.5) 40 decibels for 102.5, 45 decibels for 104.5	-40 for 102.5 45 for 104.5 usually not heard	May have had former Ch. S. O. M.	++	Usually 25-40
Group III	May have 100% deafness at any frequency	Usually 40 and 51.5 are heard	-40 for 40 and 51	May or (may not) be present	+ or --	Usually elderly though occasionally in early twenties

Hearing improved and the improvement was lost later in 39 per cent.

Hearing was not improved in 7 per cent.

Hearing became worse in 3 per cent.

The degree of improvement is not specified, nor is the final hearing level attained by the patient mentioned.

An interim report (patient's operated upon less than 2 years previously) on the author's last 450 cases in the past 18 months under the previously mentioned groupings is as follows:

Group 1 Hearing was improved to the practical level and maintained in 86 per cent.

Group 2 Hearing was improved to the practical level in 33 per cent.

Group 3 In 3 cases, no improvement was noted.

In the latter series the author has not had a case in which the fistula has completely closed as judged by the fistula sign on probing.

The author emphasizes the importance of detailed follow through records of the operative technique together with standardized audiometric records to all surgeons actively engaged in the fenestration operation. **EVONKE L. DERLACKI, M.D.**

## NOSE AND SINUSES

**Orbital Complications Resulting from Lesions of the Sinuses.** **AUSTIN T. SMITH and JAMES T. SPENCER.** *Ann. Otol. Rhinol.*, 1948, 57: 5

The authors present 12 cases illustrating infections, mucocoeles, epidermoid cysts and osteomas of the paranasal sinuses responsible for complications of the orbit. The intimate anatomical relationship between the sinuses and the orbit allows for ready involvement of the orbital contents by inflammatory and other lesions of the sinuses.

The diagnostic problem involved in the orbital complications depends upon a consideration of the symptomatology as follows:

1 The symptoms of inflammatory changes in the orbit such as (a) inflammatory edema of the eyelids, (b) subperiosteal abscess—a collection of pus between the bony wall and the periorbital, (c) orbital abscess (d) orbital cellulitis and (e) cavernous sinus thrombosis of the anterior or orbital type.

2 The symptoms of disturbances from mechanical causes due to encroachment upon the capacity of the orbit by mucocoeles, pyococci, chronic hyperplastic sinusitis, cysts and neoplasms, and manifested by displacement and disturbance in the mobility of the globe, injury to the optic nerve, changes in refraction and disturbance in the drainage of tears.

3 The orbital apex or sphenoid fissure syndrome, a syndrome consisting of ptosis, complete ophthalmoplegia, impaired vision, and pain corresponding to the ophthalmic division of the fifth nerve which is caused by affection of the vessels and nerves which pass through the superior orbital fissure and the optic foramen.

The authors found in their study that difficulty and delay in diagnosis arose because (1) the sinus

infection was not apparent from symptoms or rhinologic examination (2) a noninflammatory lesion was obscured by inflammatory reaction (3) in spite of a history of sinus infection, the focus was elsewhere and (4) lesions of the sinuses such as mucocoeles, cysts, or osteomas gave no nasal symptoms and encroached on the orbit so gradually that eye symptoms were not manifest until the involvement became marked.

The authors believe that roentgen examination was the greatest single aid in the diagnosis but it must be correlated with the clinical evidence.

As for treatment, inflammatory conditions causing orbital infections are most efficaciously treated with penicillin in adequate dosage given parenterally which largely obviates the previously practiced customary procedures. As for the lesions which cause disturbances by mechanical means the authors advocate surgical incision and drainage through the sinuses into the nose in cases of mucocoele, pyocoele and hyperplastic lesions or surgical removal of neoplastic lesions such as osteomas, followed by the establishment of adequate nasal drainage.

In illustrating the problems of diagnosis and therapy the authors reviewed the case histories of (1) 6 cases of the inflammatory group (2) 3 cases of mucocoele (3) 1 case of epidermoid cyst of the frontal bone, and (4) 2 cases of osteoma of the frontal and ethmoid sinuses. **EVONKE L. DERLACKI, M.D.**

## MOUTH

**Oral Conditions with a Background of Systemic Disease.** **KURT H. THOMA, DANIEL J. HOLLAND, JR., HOWARD W. WOODBURY, JARREL G. BURROW, and EDWARD L. SLEEPER.** *Oral Surg. M. Path.*, 1948, 1: 8.

This article concerns the report of 2 cases of oral disease which represent very dramatic examples of the importance of co-operation between the dental, medical, and surgical services for proper diagnosis and treatment of diseases the first symptoms of which may occur within the oral cavity. The neglect of a complete physical examination in such cases may cause very embarrassing results.

The first case was that of tumor of the maxilla associated with hypoparathyroidism. This case was that of a 62 year-old farmer who was referred to the dental clinic for treatment of a firm nontender, asymptomatic swelling of the left side of the face of 3 weeks duration. This tumor involved the anterior portion of the left alveolar process and caused the left cheek to bulge. It had increased progressively for 3 weeks. The patient was referred by the dental clinic to the laboratory for blood studies after a biopsy of the lesion which came back as a giant-cell epulis.

The presumptive diagnosis of hypoparathyroidism was made at this time from the blood studies. Surgical intervention was discouraged and the patient was referred to the medical service of the hospital for further study. At that time the complete medical

history revealed that 4 months prior to admission the patient had noticed swelling of the right maxilla anteriorly, and 3 months previously he had consulted a local physician, who had excised the mass and removed a tooth root. After that, all his teeth were removed. Four weeks previously the patient had a similar swelling of the left maxilla anteriorly and he again consulted his physician, who believed the swelling to be similar to that on the other side and incised it obtaining a bloody mucoid material. The completion of the operation was deferred because of the size of the mass. The patient was then referred to the dental clinic.

During the past 4 months the patient had also noticed excessive fatigue, extreme weakness, vomiting polydipsia and polyuria. His condition had become progressively worse. Physical examination disclosed bilateral firm nontender soft tissue mass in the antero maxilla. This was associated with a firm nodular swelling believed to be localized in the left side of the lower neck, probably within the thyroid. The remainder of the physical examination was negative. X-ray examination revealed cystic degeneration of the maxilla, granular appearance of the skull, and other bony decalcifications consistent with a diagnosis of osteitis fibrosa cystica.

It was agreed that surgical exploration of the parathyroids with presumptive diagnosis of parathyroid adenoma was indicated. Because of the poor physical condition the operation had to be deferred temporarily but it was done finally and bore out the clinical impression a large cystic parathyroid adenoma was extirpated. Closer exploration was not possible because of the condition of the patient. Postoperatively the patient's course was good except for a kidney complication which was treated by sulfadiazine. He also had several thromboses of the deep veins. However some time after he had recovered from the complications he stated that he had not felt so well for years.

This is one example of a case in which local excision of a tumor should not be done unless a complete physical examination and other studies are carried out. It is felt that such studies are not done often enough.

The second case mentioned in this article was a thrombocytopenic purpura associated with bleeding from the gingiva. First a very brief description of the etiology of the platelets in the clotting mechanism of the blood is given. The patient was admitted to the hospital on June 6, 1947 with the chief complaint of back pain and loss of weight. Examination was essentially negative, and a diagnosis of osteitis condensans illi was made. Laboratory findings on the initial admission were given. The patient returned home following instructions, but she began to have continuous, rather profuse bleeding from the gums. She also developed prolonged abnormal profuse menstrual bleeding.

On admission again on July 5, 1947 a diagnosis of purpura was made. This was confirmed by physical examination as well as physical examination

ciated tests. A detailed account of the examination and laboratory tests is included in the report. The oral examination showed profuse bleeding from the gums, which did not respond to any local treatment. On July 9, 1947 a splenectomy was performed. On the first 2 postoperative days the bleeding diminished and 3 times stopped completely. However, after the third postoperative day she began to bleed again and her condition progressively became worse in spite of blood transfusions and other supportive treatment she died on August 9, 1947. The autopsy revealed typical pictures of thrombocytopenic purpura.

The second case shows the possibility of a generalized disease with only local symptoms when first seen. The authors intimate that a patient with any type of bleeding that does not quickly resolve with local treatment should have a very complete examination for systemic disease.

The reports of these 2 cases include photographs of the lesions in question, some photomicrographs, and a detailed description of the laboratory work done on these patients. WILLIAM A. ARBROOK, M.D.

**Gelatin Sponge in the Obliteration of Cavities Resulting from the Excision of Cysts and Tumors of the Jaw.** KURT H. THOMA and EDWARD L. SLEPPER. *Oral Surg. M. Path.*, 948, 24.

The authors briefly discuss the difficulties encountered in the obliteration of large cavities left by the enucleation of cysts of the jaw. The need of packings and the contamination from the mouth are all contributing factors to the breakdown of blood clots which fill the cavities following operation. The problem is not great in small cavities resulting from these cysts but in large ones the complications are of importance.

The aim in the treatment of large cysts of the jaw is always to remove the entire cystic epithelium and its contents with the exception of the involved roots and dentigerous cysts where normal eruption is likely to take place. If at operation the teeth in this condition are not interfered with, their normal eruption will take place. The authors state that the Partsch operation has its disadvantages because of the postoperative difficulties of taking care of the patient and the fact that usually a depression marks the site of the former cavity. They briefly report the method of space obliteration that has been worked out in various ways by other workers.

Synthetic bone paste has some advantages, particularly in small cavities which, however, usually need no filling material. The difficulties encountered in filling large cavities with bone paste are given.

The authors give a brief description of the use of fibrin foam and gelfoam in filling such large cavities following operation on cysts of the jaw. They briefly give the histological picture concerning the absorption of this filling material and the absorption of bone formation. They state that gelatin sponge in such large cystic

cavities is probably much the same as that when the sponge is transplanted into soft tissues.

The authors state that before inserting the fibrin foam or gelfoam into the wound it should be soaked in a solution to make it more pliable and more readily adaptable to the cavity. It will soak in either normal saline solution in which no infection is present or in a thrombin solution with or without penicillin according to whether or not there is considerable bleeding and if or not infection is present. The use of it when the cavity is not exposed to oral bacteria presents no problem but in the authors experience it has caused very little trouble even if the oral contents have gotten into the wound.

The authors then report in some detail the history, examination and procedures carried out in 11 cases of large cystic cavities of the jaw in which gelfoam or fibrin foam was used to pack the cavities following the operation.

WILLIAM A. ABROOM, M.D.

#### Plastic Surgical Repair of Facial Paralysis. PAUL W. GRIELEY. *Arch Surg* 1948 56 132

This article is a brief general discussion of the present day status of surgery for facial paralysis. The selection of the patient for surgery, the optimum time for operation and the desirability of neurosurgical consultation are discussed.

Primary nerve suture or nerve graft when sufficient substance has been lost should be done whenever possible. When such procedure is impossible resort must be had to measures which will support the paralyzed side. Antogenous fascia lata strips may be used purely as support. When combined with muscular attachments some activation may be obtained. Muscle pedicled flaps utilizing temporal muscle for the corners of the mouth and the eyelids lend animation but not necessarily support and are best used in conjunction with fascial support. Nerve substitution and use of foreign body material such as tantalum are not recommended.

EARL H. KLASOWSKI, M.D.

#### Surgical Correction of Developmental Deformities of the Mandible. REED O. DIXON. *Plast Reconstr Surg*, 1948 5 124

The first record of the use of a surgical procedure for correction of malrelation of the jaws dates back to 1848. It has been only during the past 50 years however that much interest has been shown in the surgical correction of prognathic deformities of the mandible. When one considers the great number of operations proposed for correction of this deformity and also the various operations in use today, it is obvious that there is lack of uniformity of thought in regard to this problem. It is also evident that there is no one operation without some undesirable features.

Osteotomy is accomplished by transverse division of the ramus of the mandible, and shifting of the body of the bone backwards where it is held in position during the course of healing.

It is today the most popular of the operative procedures because it is simple to execute, avoids the

possibility of injury to the inferior alveolar nerve, it does not entail sacrifice of useful bone, nor does it damage the mandibular arch or teeth. The operation also can be done without contamination with the oral cavity. There are, however, numerous disadvantages, very few of which have been given adequate mention in the literature.

Although excellent results have been obtained in the correction of prognathic deformity by the method of osteotomy, there are many disadvantages to the procedure, and the possibility of failure is great. (1) possibility of lack of control of upper or proximal segment due to muscular action with separation of fragments and nonunion. (2) nonunion is possible. (3) osteotomy through the neck of the condyle may result in destruction of function of both temporomandibular joints. (4) osteotomy through the neck by the blind passage of a gigli saw has the disadvantage of inability to control the proximal fragment with the possibility of injury to seventh nerve and internal maxillary artery and the possibility of throwing the muscles of mastication out of normal alignment. (5) a transverse cut too close to the sigmoid notch offers the possibility of separation of the coronoid from the condyloid process.

The alternate choice of site of operation, to that of cutting through the ramus of the mandible, is section through the body of the mandible or osteotomy. In osteotomy, a previously measured section of bone is removed from the body of the mandible.

The removal of a section of bone from the body of the mandible has numerous advantages. The operative site is more accessible and the fragments can be more easily controlled and held in position with very great accuracy by means of dental splints fitted to the teeth or to the alveolar ridges of the mandible. In sectioning through the body of the mandible there is no interference with the muscles of mastication and there is no possibility of an open bite relationship developing after the anterior fragment has been placed accurately in position. The chief objections to this procedure are the sacrifice of functional teeth in many instances and destruction of normal bone at the site of osteotomy.

The advantages of osteotomy are: (1) osteotomy affords the greatest possibility of avoiding the mandibular nerve and associated structures. (2) It is easy to execute. (3) it avoids the extraction of normal teeth and the sacrifice of useful bony structure and (4) also avoids the possibility of oral contamination.

The author advocates a two stage method of osteotomy, a modification of the method introduced by Harsha in 1912, by which a section of bone is removed from the body of the mandible without interfering with the inferior alveolar nerve and associated structures. The procedure consists of removal of a section of bone from the body of the mandible without cutting the inferior alveolar nerve or compound ing the wound intraorally.

The first stage is a relatively minor procedure and the patient is treated under local anesthesia as an

out-patient. If the area is edentulous, this consists of making an incision along the crest of the alveolar ridge and gingival margins of the adjacent teeth, and elevating the mucoperiosteum from the buccal and lingual surfaces in the immediate vicinity. If a tooth is removed at the same time the mucoperiosteum is elevated from the buccal and lingual plates opposite the area of extraction. Using a bone drill, the bone is cut downward and transversely across the alveolar ridge. In order to avoid injury to the inferior alveolar nerve, a safe distance is maintained between the depth of the bone incision and the nerve. The bone is not removed at this time. The soft tissue is returned to position and carefully sutured in place over the ridge.

During the second stage, incisions are made bilaterally parallel and 1 cm. below the inferior border of the mandible in the selected area. Careful dissection should be done to avoid the mandibular branch of the facial nerve. Through this incision the lower border of the body of the bone is exposed. By carefully retracting the periosteum a slight amount, medially and laterally the cuts in the bone from the previous intraoral stage are readily identified. By the use of bone drills, these cuts are extended through the cortical plate of bone down to the lower border of the mandible. A horizontal cut through the cortical plate on the lateral surface about 1 cm. above the inferior border and between the two vertical cuts permits the insertion of a small chisel. A twisting motion fractures off the lower border of the bone, exposing the nerve. Great care is exercised in order to avoid the mandibular nerve, which is carefully exposed by removal of the surrounding medullary bone. After identification of the nerve and before the bone is completely excised, holes are drilled with a small bone drill from the buccal to the lingual nerve just above the inferior border of the bone on both sides of the osteotomy site. These small holes provide pathways for passage of 22 gauge stainless steel or tantalum wire, which is used to approximate the bone fragments. The medullary portion of the bone is then countersunk or hollowed out in the immediate vicinity of the nerve to permit a resting place for the excess of nerve when the bone fragments are approximated. After excision of the bone up to the nerve, it is quite simple to remove the entire block of bone above the nerve without getting into the oral cavity. The bone should be wired securely to prevent slipping or upward riding of the posterior fragment due to action of the closing muscles of mastication. The wires are twisted tightly and cut short.

Retraction deformities in which the mandibular teeth are within the normal limits of occlusion with the maxillary teeth may be satisfactorily corrected by bone or cartilage implants to the anterior surface of the mandible. In marked retraction deformities with malocclusion, implants of this kind fall short of producing the ideal result.

A procedure designed to advance the bone in order to improve the occlusal relationships as well as

the contour of the chin seems advisable in certain deformities.

The author has employed a two stage operative procedure for correction of retraction deformities of the mandible in 3 cases. The operation is done through the body of the mandible and is accomplished in such a way that the inferior alveolar nerve and its associated structures are not destroyed. The operation being done through the body of the mandible offers the distinct advantage (over operations done through the ramus) of noninterference with the muscles of mastication. LOUIS T BYARS, M.D.

**Osteomyelitis of the Jaws.** KURT H THOMA, DANIEL J. HOLLAND JR., HOWARD W. WOOD, URY JARRELL G. BUTEROW and EDWARD L. SLEEPER. *Oral Surg. M. Path.* 1948, 76.

The authors state that the treatment of bone infection that was developed by them has continued to give good results. This treatment consists in combining the use of antibiotics appropriate for the infecting organism with adequate surgery to remove dead and infected bone, followed by careful débridement of the area and sanerization of the bone defect. The antibiotics are given intramuscularly but are also supplemented by local instillation directly into the involved areas.

The authors give in some detail the case histories of several cases in which this technique was carried out with satisfactory results. These cases were (1) acute osteomyelitis of the mandible associated with infected wen, (2) subacute osteomyelitis of the ascending ramus (3) osteomyelitis of the mandible following tooth extraction (4) chronic osteomyelitis of the mandible following accident, and (5) irradiation necrosis of the maxilla.

WILLIAM A. AEROGU, M.D.

## NECK

**Thyroiditis.** GEORGE CRILE, JR., *Ann. Surg.* 1948, 127: 640.

This study concerned with the 3 main clinical types of thyroiditis, consists of 27 cases of subacute thyroiditis, 14 cases of struma lymphomatosa, and 11 cases of Riedel's struma. Each of these conditions is a distinct entity of unknown etiology and probably unrelated to the other two. All of them occur predominantly in the female and as a rule, after the fourth decade.

Subacute thyroiditis is much more common than the others. It may be the consequence of a virus infection, and is considered the same disease as pseudotuberculous or giant-cell thyroiditis. It is characterized by a diffuse subacute inflammation with numerous foreign-body giant cells, probably related to the colloid in the degenerating follicles. A firm, symmetrical enlargement of the gland occurs but this is seldom pronounced.

In contrast to the other types, the onset is usually sudden, pain and thyroid tenderness is marked and there is evidence of a systemic toxic reaction but

true hyperthyroidism does not appear. Easily recognized subacute thyroiditis tends to subside spontaneously without significant alteration of the thyroid function. Irradiation brings about a prompt and dramatic response and obviates the need for thyroidectomy. Thiouracil may be beneficial.

Struma lymphomatosa also known as Hashimoto's thyroiditis is a progressive disease which appears to be related to deficiency disorders. Histologically one notes an extensive acidophilic element by fibrous and notably lymphoid tissue containing well developed germinal centers. The process is diffuse and while the entire gland increases markedly in size its shape becomes somewhat asymmetrical.

Struma lymphomatosa is insidious in onset and usually asymptomatic except for the hypothyroidism or at least a peculiar hypometabolism which does not always respond specifically to glandular extract. Occasionally when the trachea is encircled symptoms of obstruction appear. In the rare case in which the diagnosis is made preoperatively resection of both lobes is recommended when the disease is recognized at operation as the morbidity is high following radical resection.

Riedel's struma, also known as woody or ligneous thyroiditis is the least common of the 3 conditions. The typically concentric laminations of fibrous tissue surrounding degenerating adenomas suggest that some change in the adenoma may be responsible for the reaction. In contrast to the other conditions the inflammatory process is limited as a rule to one lobe and is productive of a very large bulky stone-confining of the capsule to infiltrate and involve the trachea and adjacent structures. This process is slow but progressive and may be indistinguishable from advanced carcinoma preoperatively.

It commences without pain tenderness or systemic symptoms. However pressure symptoms often with tracheal obstruction, are present in over one-half of the cases. Irradiation is of little or no value and surgery is apt to be difficult. It is unwise, move the entire lobe. Removal of the core containing the adenoma when possible appears to relieve the symptoms and promote subsidence of the fibrous proliferation.

DAVID H. LYNN, M.D.

A Contribution to the Knowledge of the Frequency of Thyrotoxicosis in Finland during the Years 1935-1946. O. BISTRÖM. *Acta med scand.*, 1948, 130: 109.

The author examined the records of the Helsingfors City Hospital and the General Hospital of Helsinki for the years 1935 to 1946, inclusive. Townspeople were treated in the former hospital and country people in the latter. Since both institutions are associated with the University the diagnoses were accepted as reliable.

Of 214 thyrotoxic patients only 241 (11 per cent) were males. Most of the patients were in the fourth decade but there were 2 in the first decade and 15 in the eighth or a later decade. In 1935 there was a total of 155 cases of this disease in the two hospitals.

In the succeeding years ending with 1946 the numbers were 217, 203, 188, 255 (1939), 206, 234, 126, 162, 99, 174, and 185. The peak years were 1936 (217 cases), 1939 (255 cases), and 1941 (234 cases). The low years were 1942 (126 cases) and 1944 (99 cases). The curve representing these figures was very much the same as that in the graphs for (a) the number of thyrotoxic patients per 1,000 total patients in the hospitals for each year, (b) the severe cases and (c) the incidence of exophthalmos. No great difference was noted between the curves for the townspeople and the rural people.

The author correlates the graphs with various factors particularly with change in psychological tension and with food supply. He believes that the most likely factor influencing incidence and severity is the food supply. At least, the smallest number of cases occurred during the period of greatest scarcity of food and the greatest number at times of greatest availability of foods especially protein and fat.

CLINTON H. THIRTEEN, M.D.

Subglottic Cylindroma with Special Reference to Its Clinical Course. DAVID IDE and HERBERT L. CAHN. *Laryngoscope*, 1948, 58: 338.

The authors emphasize that every case of clinical asthma should be studied by endoscopy for tracheobronchial pathology. Primary malignant disease of the trachea is rare. Cylindromas are tumors in which hyaline strands or balls are interspersed with strands of flattened cells. They are generally benign but may metastasize and they are generally benign in origin arising from the glands or surface epithelium of the mouth and nasopharynx.

A case is reported of a 52-year-old white male, whose complaints were a choking sensation, bloody expectoration, dyspnea, and dysphagia of 2 years' duration. He was in great distress with a wheezing respiration. A previous diagnosis of asthmas had been made. Laryngoscopy revealed a subglottic mass from which biopsy material was obtained. The pathological report described only chronic inflammation. The patient's condition improved but symptoms recurred in a month at which time surgery consisting in tracheotomy and removal of the subglottic mass with fulguration of its base was performed. The pathological diagnosis was cylindroma. The tracheotomy tube was removed on the third postoperative day and the patient made an uneventful recovery and obtained complete relief of all symptoms.

There is diversity of opinion as to whether surgery or radiotherapy should be advised in the treatment of these tumors. In this case surgery proved a safe and remedial procedure.

S. LLOYD TRITTMAN, M.D.



**The Use of Contact Therapy in the Treatment of Carcinoma of the Larynx.** BRUCE PROCTOR, JAMES L. LOFFSTROM, and CARL E. NURNBERGER. *Laryngoscope* 1948, 58 5.

Since April, 1946 the authors have treated 9 patients with carcinoma of the larynx by the technique of laryngofissure and contact x ray therapy. Eight of the patients were of the type usually treated by laryngectomy or massive external irradiation, but they either had refused such irradiation or had complications which were contraindications for the more radical treatment. During the 21 months of the study, only one recurrence occurred (at 4.5 months). The dose varied from 5,000 to 12,000 roentgens.

An elaborate description of the radiation technique with dosage charts is given in this 18 page report. CLINTON H. THURVEY, M.D.

**Extirpation en Bloc of the Larynx and of the Lateral Cervical Nodes on One Side (Asportazione in blocco della laringe dei gangli laterocervicali mono-laterali)** VITTORINO PANCIOLO. *Chirurgia* 947

45

The author describes his procedure in the surgical treatment of cancer of the larynx and its metastases. He removes the larynx and the cervical lymph nodes on one side en bloc.

A basal preanesthetic is given, followed by local infiltration of both the superficial and deep tissues the larynx and the cervical plexus.

A U<sup>l</sup> incision is made through the skin and subcutaneous tissue extending from the mastoid on one side, along the posterior border of the sternocleidomastoid muscle above the clavicle and to the opposite mastoid. After the posterior margin of the sternocleidomastoid is freed, and the sheath of the trachea is opened the sternocleidomastoid muscle is sectioned at its insertion to expose the scalenus muscles. All adipose tissue is removed from the supraclavicular space. The thyrohyoid, the transverse cervical vessels and some rami of the cervical plexus are sectioned. After the internal jugular vein is ligated

at the base of the skull and at the clavicle. Attention is paid to the facial and hypoglossal nerves when the posterior belly of the digastric and stylohyoid muscles is detached. The spinal nerve accompanying the internal jugular vein was sectioned, as were the superior laryngeal nerve and vessels. The posterior border of the thyroid cartilage is freed and the hyoid bone is separated from the suprahyoid musculature always from the back to the front. The posterior margin of the thyroid gland is liberated from the thyroid cartilage without opening of the perichondrium but the constrictor fibers are separated.

When the larynx has been isolated by this procedure an endotracheal and an endolaryngeal anesthetic block is effected. The trachea is sectioned below the cricoid cartilage; the dissection starting from below and the pharynx is thereby opened as far as the base of the tongue. The larynx is excised en masse with the hyoid bone and with the nodes of the jugulocarotid chain on one side of the neck. The pharyngeal wound is closed with two layers of continuous catgut No. 00, with care to avoid entering the mucosa with the suture. The author then sutures the trachea to the skin and places a gauze drain on the side of the removed internal jugular vein and a rubber drain on the opposite side.

In 2 patients in whom the cancer had metastasized to the cervical nodes on both sides the operation was done in two stages. Extirpation of the larynx en bloc with the lymph nodes and internal jugular vein was done first on one side of the neck, followed after one month by the second operation during which the lymph nodes and the internal jugular vein on the opposite side of the neck were removed. The histological examination showed metastases in both sets of nodes. After 3 years of observation no ill effects were seen in these patients.

Fifteen patients have been operated upon by this technique without a mortality or complication, either operative or postoperative. No fistulas formed.

VITTORIO F. CIRIELLO, M.D.

# SURGERY OF THE NERVOUS SYSTEM

## SPINAL CORD AND ITS COVERINGS

**Paraplegia in Cervical Spine Injuries.** ROLAND BARKER. *J Bone Surg.*, 1948 30B 234.

One of the most puzzling features of injuries of the cervical spine is the lack of correlation between the degree of vertebral displacement and the severity of the spinal-cord lesion.<sup>1</sup> The author is convinced that spinal-cord injury can occur in the absence of any vertebral dislocation. Twenty two cervical spine injuries are classified into flexion and hyperextension types. The former group is further subdivided into (1) anterior dislocation (2) acute retropulsion of an intervertebral disc, and (3) crush fractures of a vertebral body. The hyperextension types are (1) posterior dislocation and (2) injury to an arthritic spine.

Cord damage in the nine cervical dislocations was due to a combination of pressure on the dorsal surface by dislocated neural arches and simultaneous compression of the ventral surface of the cord by a retropulsed disc. Skeletal traction was the treatment of choice.

Three cases of acute retropulsion of the intervertebral disc are presented only one of which was actually visualized at operation; the 2 other patients were merely treated by skeletal traction and recovered partially from their paralysis. Because of the narrowed intervertebral disc space and the absence of x ray evidence of bony injury retropulsion of the disc was inferred. Treatment varied with the case.

If the disc was not regarded as degenerated before injury traction was used to restore the disc height. If paralysis was incomplete and the Queckenstedt test was normal, the cord was regarded as being under severe compression, and a trial of skeletal traction was justified. If there was no recovery from paraplegia within a few days laminectomy was considered even though the Queckenstedt test was normal.

In 4 cases there was a marked crush fracture of the vertebrae with destruction of the cord of varying severity. In one of these cases there was compression of the ventral surface of the cord by an extruded disc. Treatment of these injuries was similar to that used for spinal-cord compression due to a retropulsed disc.

There were 6 cases of hyperextension injury to arthritic spines. All of the patients were over 50 years of age and had moderate or severe changes of the spine without roentgenographic evidence of recent vertebral injury. The mechanism of this type of injury is discussed. With hyperextension of the cervical spine there is rupture of the anterior common ligament, avulsion of a small bit of bone from the anterior margin of the upper vertebra, and a tear through the disc. The latter does not extend into the canal. No resistance is offered to further hyperex-

tension, and wider separation of the bodies occurs. After the initial trauma, normal alignment of the vertebrae is restored by spasm of the neck muscles and there is no apparent distortion noted in the roentgenogram of the spine.

Minor displacements of spurs on the vertebrae may cause concussion of the cord. The author has likewise postulated that a traction injury to the cord may occur since neurological levels corresponding to several segments above the point where hyperextension has occurred are found. Experimental work performed by the author does not tend to substantiate this theory but he is not satisfied completely with the methods used. There is no indication for the use of traction in these cases. Neither is immobilization in plaster necessary; this is uncomfortable and often dangerous in the older patients usually found with this condition. Treatment is best accomplished by gentle flexion of the cervical spine produced by placing a pillow under the head.

RICHARD C. SCHWEIDLER, M D

**Paraplegia in Hyperextension Cervical Injuries**  
ALEXANDER R. TAYLOR and WILLIAM BLACKWOOD  
*J Bone Surg.* 1948, 30B 245

Damage to the cervical part of the spinal cord with paraplegia may occur without x ray evidence of dislocation or injury of the vertebrae. Several mechanisms have been postulated. One is that the massive prolapse of a disc may cause pressure on the cord, however the authors state that this lesion can usually be recognized in the roentgenograms by a slight narrowing of the intervertebral space. Another suggested etiology is a hyperflexion dislocation which causes paraplegia with spontaneous reduction but the authors believe that a flexion of this severity would be sufficient to cause in addition a crushing of the vertebrae or dislocation of their facets and thus be detectable roentgenographically.

Forced hyperextension of the spine without x ray evidence of displacement is proposed in this article as the usual mechanism of the type of injury described. Two cases are presented to illustrate this point. It is thought that this factor was overlooked for so long because surgeons have been indoctrinated with the belief that the anterior ligaments are so strong they will not rupture, and the assumption that if there is severe hyperextension of the cervical spine the atlas and axis will fracture through the arches at the base of the odontoid.

The differential diagnosis lies mainly between acute prolapse of the intervertebral disc and hyperextension injury with immediate reduction. Very minor changes in the roentgenogram such as narrowing of the intervertebral disc space or the suspicion of wedging of the vertebrae suggest a ruptured disc. Myelography should demonstrate a disc of sufficient size to cause damage to the cord. On the

**The Use of Contact Therapy in the Treatment of Carcinoma of the Larynx.** BROCK PROCTOR, JAMES E. LOFSTROM and CARL E. NURNBERGER. *Laryngoscope* 94:5, 58-59

Since April, 1946 the authors have treated 9 patients with carcinoma of the larynx by the technique of laryngofissure and contact x ray therapy. Eight of the patients were of the type usually treated by laryngectomy or massive external irradiation, but they either had refused such irradiation or had complications which were contraindications for the more radical treatment. During the 21 months of the study, only one recurrence occurred (at 4 1/2 months). The dose varied from 5,000 to 12,000 roentgens.

An elaborate description of the radiation technique with dosage charts, is given in this 8 page report.

CLINTON H. THURMAN, M.D.

**Extirpation en Bloc of the Larynx and of the Lateral Cervical Nodes on One Side (Asportazione in blocco della laringe dei gangli laterocervicali mono-laterali.)** VITTORIO PICCOLO. *Chirurgia* 947: 45

The author describes his procedure in the surgical treatment of cancer of the larynx and its metastases. He removes the larynx, and the cervical lymph nodes on one side en bloc.

A basal preanesthetic is given followed by local infiltration of both the superficial and deep tissues, the larynx and the cervical plexus.

A U incision is made through the skin and subcutaneous tissue extending from the mastoid on one side along the posterior border of the sternocleidomastoid muscle, above the clavicle and to the opposite mastoid. After the posterior margin of the sternocleidomastoid is freed and the sheath of the trachea is opened the sternocleidomastoid muscle is sectioned at its insertion to the scapular muscle. All adipose tissue is removed from the supraclavicular space. The omohyoid, the transverse cervical vessels and some rami of the cervical plexus are sectioned after the internal jugular vein is ligated

at the base of the skull and at the clavicle. Attention is paid to the facial and hypoglossal nerves when the posterior belly of the digastric and stylohyoid muscles is detached. The spinal nerve accompanying the internal jugular vein was sectioned as were the superior laryngeal nerve and vessels. The posterior border of the thyroid cartilage is freed and the hyoid bone is separated from the suprahyoid musculature always from the back to the front. The posterior margin of the thyroid gland is liberated from the thyroid cartilage without opening of the perichondrium, but the constrictor fibers are separated.

When the larynx has been isolated by this procedure an endotracheal and an endolaryngeal anesthetic block is effected. The trachea is sectioned below the cricoid cartilage the dissection starting from below and the pharynx is thereby opened as far as the base of the tongue. The larynx is excised en masse with the hyoid bone and with the nodes of the jugulocervical chain on one side of the neck. The pharyngeal wound is closed with two layers of continuous catgut No. 00, with care to avoid entering the mucosa with the suture. The author then sutures the trachea to the skin and places a gauze drain on the side of the removed internal jugular vein and rubber drain on the opposite side.

In 3 patients in whom the cancer had metastasized to the cervical nodes on both sides, the operation was done in two stages. Extirpation of the larynx en bloc with the lymph nodes and internal jugular vein was done first on one side of the neck, followed after one month by the second operation during which the lymph nodes and the internal jugular vein on the opposite side of the neck were removed. The histological examination showed metastases in both sets of nodes. After 3 years of observation no ill effects were seen in these patients.

Fifteen patients have been operated upon by this technique without a mortality or complication either operative or postoperative. No fistulas formed.

VITTORIO F. PICCOLI, M.D.

separation of the cases in which the less extensive procedure alone was performed. The operative mortality was 10 per cent.

The patients in this series were operated upon during the period between 1933 and 1941. The ages varied from 14 years to 57 years of age. The greater number of patients however were in the fifth decade. Sixty-two per cent of the patients were males. The three most common complaints were headache, visual disturbances and dyspnea.

A 5 year study of the 143 patients who survived revealed that 31 of the patients or 21.6 per cent, survived for at least 5 years, 23 patients or 17 per cent lived from 5 to 12 years after surgery. In comparison with similar series of patients who had had medical treatment only, especially the Keith Wagner Barker series and the Page series, these results may be considered excellent. A study of 25 cases by Flaxman however revealed a 5 year survival rate of 34 per cent, under medical management. A re-evaluation of 21 patients who survived for 5 years or more revealed that 4 were maintaining a completely normal blood pressure. In 7 patients the blood pressure was reduced by at least 80 mm. or more systolic, and 25 mm. diastolic pressure. In 6 cases there was a significant reduction of 48 mm. systolic and 15 mm. of diastolic pressure, whereas there was no significant change in 5 cases. In 20 patients with preoperative headaches, 10 had complete relief and 9 were definitely improved. Of 14 patients with visual disturbances, all but 1 had noted definite improvement.

The preoperative complaints of angular seizures, weight loss, and muscle pain were apparently very ominous for none of the patients with these complaints had survived 5 years. Eleven out of the 13 patients without evidence of cardiac involvement prior to operation were still living 5 to 12 years after surgery. Two of 16 patients with congestive heart failure before surgery survived for a period of 5 years. Previous episodes of cerebrovascular disease were apparently of little importance, for 6 of the patients who had had previous cerebral accidents were still living and had had no recurrence.

JACK I. WOOLF, M.D.

#### MISCELLANEOUS

Recklinghausen's Neurofibromatosis Associated with Intrathoracic Meningocele. C. STUART WELCH, ALICE EITZINGER, AND PAUL L. HECHT. *N. England J. M.*, 1948, 238, 622.

The authors report a case of neurofibromatosis in a patient who showed roentgenological evidence of an intrathoracic tumor with marked erosion of the lateral and anterior surfaces of the fifth, sixth, and seventh thoracic vertebrae. Examination revealed a kyphoscoliosis in the midthoracic region but no neurological signs. A transthoracic operation showed the tumor to be a meningocele.

The authors discuss 3 previously reported cases of intrathoracic meningocele, 2 of which occurred in patients with Recklinghausen's neurofibromatosis.

They suggest myelographic studies as an aid in differential diagnosis. GEORGE PERRET, M.D.

Sacrococcygeal Chordoma. FERNANDO GENTIL and BRADLEY L. COLLEY. *Ann. Surg.*, 1948, 127, 432.

This study is based on 7 cases of sacrococcygeal chordoma observed and treated at the Memorial Hospital, New York, during the period from 1930 to 1943, and 128 instances previously reported.

Chordoma is a specific tumor arising from remnants of the primitive notochord. It is characterized by slow inexorable growth, a tendency to invade and destroy bone by direct extension, local recurrence after surgical excision, and slight or negligible regression following radiation. Occasionally distant lymph node and visceral metastases occur.

Virchow first called attention to chordoma in 1856 when he described small tumorlike cartilaginous masses at the spheno-occipital synchondrosis and termed the condition echordosis physaliphora. The term chordoma was introduced a year later by Müller. Ribbert in 1894 first established the correct nature of this neoplasm and described 5 cases of his own.

Although chordomas may occur at any age, they are usually encountered during the fifth decade, with a range of from 3 months to 78 years. They are slightly more common in males, a difference difficult to evaluate.

The bulk of evidence indicates that these tumors arise from primitive fibroblastic cells of the notochord. Of all the types of chordoma, 60 per cent were sacrococcygeal, 30 per cent spheno-occipital and 10 per cent were evenly distributed in the cervical, thoracic, and lumbar regions. The predilection of chordoma for the sacrococcygeal area has never been satisfactorily explained.

Grossly these tumors are bulky, encapsulated, lobulated, cystic, and purplish red. Cut sections reveal areas of homogeneous and translucent tissue with irregular cavities filled with abundant thin mucin. The microscopic appearance is characteristic and consists of large cells resembling bladder epithelium (physaliferous cells) which contain intracellular and extracellular mucin. These cells are arranged in cords, lobules, or a solid epithelial pattern. Sometimes a syncytial vacuolated arrangement is present. In the malignant types mitotic figures, cellular pleomorphism, hyperchromatic nuclei, and multinucleated giant cells are found. The tumor is of low grade malignancy, widespread metastases being found in about 10 per cent of the cases.

Symptoms are due to location of the growth and are dependent on expansion and destruction of the adjacent bone. The average duration of symptoms is 20 months before the patient consults a physician. Pain is the earliest and most frequent symptom causing the complaint of anal and rectal distress. Fecal and urinary disturbances may occur as the tumor invades these regions. With involvement of the posterior nerve roots, sensory disturbances in the lower portions of the body commence. In far advanced cases the picture is that of intractable pain.

ther hand, an older patient with a kyphotic deformity or a patient with a history of injury to the face or forehead suggests a hyperextension injury. Tearing of a small chip of bone from the anterior portion of the vertebral body suggests rupture of the anterior ligament and, if myelography is negative, the diagnosis of hyperextension injury is clinched. The authors are skeptical of the occurrence of "recoil" of the disc with spontaneous reduction in hyperflexion injuries. They believe that the annulus and the posterior longitudinal ligaments will not stretch sufficiently to cause contusion to the cord without actual rupture.

The diagnosis of hyperextension injuries is important because, if the customary treatment of extension is applied to this type of injury, reallocation of the spine may occur with narrowing of the spinal canal. The patient with this type of injury should be treated in a shell or immobilized between sandbags with his head in a neutral or slightly flexed position.

RICHARD C. SCHNEIDER, M.D.

#### PERIPHERAL NERVES

Pressure at the Cervicobrachial Junction. E. D. TELFORD and S. MOTTENHEAD. *J Bone Surg* 94B, 30B 249.

The causes of pressure on the neurovascular bundle at the cervicobrachial junction are many and varied. In a careful study the authors present 122 cases in which the patients were operated upon for symptoms referable to pressure on this region. There were 105 uncomplicated cases in which the symptoms in the upper extremity were classified as being due to pressure by fibrous bands from abnormal disposition of the scalene muscles, by cancellous osteomas, deformed thoracic outlets due to pressure of the clavicle on the first rib and lastly by cervical ribs. Seventy of these cases, or 66 per cent, were due to cervical ribs, while in 5 cases, or 4.7 per cent, there was no obvious cause found. Seventeen patients had complications which overshadowed the customary symptoms. Of these 15 had extensive arterial thromboses and well developed cervical ribs. The 2 other patients suffered from hyperhidrosis which was severe enough to interfere with their work and one of these also had a cervical rib.

Three controversial points concerning pressure on the neurovascular bundle are discussed. In reviewing the scalenus anterior syndrome, the authors point out that in their experience there are many people who do not get relief from anterior scalenotomy. Those who benefit from the operation fall into a group in which the action of the anterior scalene muscle is passive and mechanical, i.e., fibrous bands actually do occur wide insertions of the muscle on the cervical rib are present, or overlapping with the scalenus medius occurs. The active action of the scalenus anterior muscle attributed to spasm disease, or injury is discounted completely. The authors do not feel that there is justification for the diagnosis of "scalenus anterior syndrome" and opera-

tion directed at sectioning of the anterior scalene muscle alone.

As to the costoclavicular syndrome, conclusions were formed on the basis of extensive clinical studies on 120 medical students and more than 50 careful cadaver dissections. If there is a normal relationship between the clavicle and the first rib there can be no compression of the neurovascular bundle against the rib. However if this space is narrowed either by a large cervical or abnormal first thoracic rib, then any retraction and abduction of the shoulder may lead to pressure symptoms. Depression of the clavicle is the normal individual cause none of these symptoms because the further the shoulder is depressed the wider is the costoclavicular space.

Arterial thrombosis, a serious complication of cervical rib, is carefully reviewed. The authors believe that thrombosis may occur as a result of pressure which causes constant irritation of the sympathetic fibers of the lowest trunk of the brachial plexus. Prolonged arterial spasm occurs secondarily. However, in some of the cases a gross abnormality of the vessel wall which could not be attributed to this cause was noted at operation. This change was explained by paralysis of the vasomotor nerves which degenerate as a result of repeated contusions. Secondary dilatation and stretching of the denervated middle coat of the vessel extends distal to the site of the injury just as far as the point at which the next nerve relay enters. No doubt, after prolonged trauma or stretching of this aneurysmal dilatation, thrombosis takes place.

In conclusion, it was emphasized that operations for the relief of symptoms due to pressure on the neurovascular bundle of the upper extremity should not be carried out with the thought of doing one pre-conceived procedure, but should be done in the nature of an exploration with wide enough exposure for adequate investigation of the entire region.

RICHARD C. SCHNEIDER, M.D.

The Problem of Malignant Hypertension and Its Treatment by Sympathetic Resection. MAX M. PEET and ERIC M. TIERRO. *Ann. Int. M* 94B, 52 755.

Despite an occasional report in the medical literature listing malignant hypertension as a contraindication to sympathectomy the authors refute this statement and present a series of 143 patients with malignant hypertension who have been treated by Peet's supradiaphragmatic sympathectomy. The diagnosis of malignant hypertension is based upon the following criteria: (1) a rapidly progressive deteriorating clinical course of recent onset; (2) severe neuroretinitis with a definite papilledema of one diopter or more; (3) high diastolic blood pressure; and (4) evidences of constitutional involvement.

The operative procedure was a one-stage resection of all of the splanchnic nerves and also of the eighth through the twelfth thoracic sympathetic ganglia. Although in the earlier operations only the three lower dorsal ganglia were removed, there was no

# SURGERY OF THE THORAX

## TRACHEA LUNGS, AND PLEURA

**Cancer of the Lung. Interval and Late Results of Operation in Relation to Topography and Gross Pathology** HAROLD NEUBER and ARTHUR H. AUSTIN. *J Thorac Surg.*, 1948, 17, 197

Fifty two consecutive patients surviving operation for lung cancer during the 10 year period from 1935 to 1945 at the Mount Sinai Hospital New York, are divided into three 'topographic' groups and show the following

Group I (21 cases) consisted of the main and branch bronchus cancers. Twenty patients were treated by pneumonectomy 7 (33%) now survive

Group II (18 cases) consisted of circumscribed cancers which appear encapsulated grossly. Six patients were treated by pneumonectomy with survival of 50 per cent and 12 were treated by lobectomy with survival of 33 per cent.

Group III (13 cases) consisted of peripherally invasive cancers. Twelve patients were treated by lobectomy with survival of 33 per cent.

The authors state that (1) topographic classification should be used as a basis for operability, (2) lobectomy has its indications in the surgery of pulmonary carcinoma and (3) prognosis based on microscopic features cannot be made with any assurance

The data presented do not permit an analysis of these conclusions. FRANK B. QUIGLEY M.D.

## HEART AND PERICARDIUM

**Coarctation and Aneurysm of the Aorta.** HAROLD B. SHUMACKER, JR. *Ann. Surg.*, 1948, 127, 655

The author reports the case of an 8½ year-old boy with coarctation of the aorta associated with an aortic aneurysm distal to the stenosis which was treated successfully by excision of the involved segment and repair by end to-end suture of the divided aorta.

The child was hospitalized because of a cardiac murmur recurrent attacks of otitis media, and a bacteremia with blood cultures positive for the pneumococcus type VII. He presented findings typical of coarctation of the aorta, and a barium swallow revealed an indentation in the esophagus in the region of the aortic arch. He was thought possibly to have bacterial aortitis and was treated with penicillin and sulfadiazine with prompt subsidence of the signs and symptoms of bacteremia and infection. The patient was then operated upon.

Operation was carried out through the bed of the fifth rib posteriorly. A coarctation of the aorta was found in the usual location and, in addition a sacular aneurysm about twice the diameter of the aorta itself the mouth of which arose immediately distal to the coarctation on the right lateral wall of

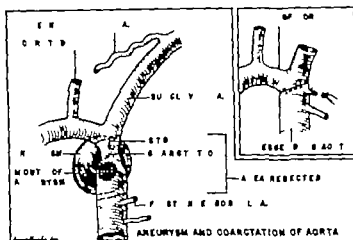


Fig 1 (Shumacker) Diagrammatic sketch of the condition found at operation. The condition following excision of the aneurysm and coarcted portion of the aorta is shown in the insert.

the aorta (Fig 1) was noted. The aneurysm and coarcted segment were excised between special clamps as a single specimen, and end-to-end suture of the divided aorta was accomplished by means of a continuous everting mattress suture of number 5 Deknatel. The patient made an uneventful recovery and when seen 8 months after operation was very well and had a brachial blood pressure of 106/70 as compared with a preoperative reading of 140/70. Pulsations in the vessels of the lower extremities were normal but had been absent preoperatively.

The aneurysmal sac was lined with platelets and fibrin but contained no demonstrable organisms, a microscopic picture not incompatible with infected vegetations rendered sterile by chemotherapy. The exact origin of the aneurysm could not be determined. Possible factors in general are atheromatosis, degeneration of the elastic tissue of the aortic wall, traction by the ligamentum arteriosum, previous bacterial aortitis with mycotic aneurysm development, and dilatation due to collateral return through aortic intercostals. Dilatation and aneurysm of the aorta may occur either proximal or distal to a coarctation, as pointed out by Abbott, and by Reiffenstein, Levine and Gross in their respective autopsy studies in cases of coarctation of the aorta. Approximately 20 per cent of the deaths in coarctation occur from rupture of the aorta and another 20 per cent occur as a result of bacterial endocarditis or aortitis.

As far as can be ascertained the case reported here is the only recorded one in which an aortic aneurysm was excised and end-to-end suture was done. Although Alexander and Byron reported excision of a thoracic aortic aneurysm with ligation of the aortic ends. However numerous cases of excision of coarcted aortic segments with end-to-end suture have been reported by Gross, Crafoord and Nylin and others.

paraplegia and incontinence. The sacrum is particularly liable to destruction.

The most constant physical finding is a mass, the exact location depending on the direction of tumor growth. The hollow of the sacrum should always be carefully palpated. Widespread metastases occur, though rarely to the lungs, liver and peripheral lymph nodes.

Sacral chordoma is strongly suggested by a bulky mass externally or in the hollow of the sacrum together with roentgenologic evidence of adjacent bony destruction. Additional evidence is involvement of the pelvic viscera and the absence of overlying skin or subcutaneous tissue invasion.

Differential diagnosis includes chondrosarcoma of the sacrum, tuberculosis of the sacrum, tumors of the female pelvic organs, tumors of the spinal cord, tumors of the sacral soft parts, sacrococcygeal teratoma, and carcinoma of the rectum.

The roentgenographic findings as concluded in the extensive study of Hsieh and Hsieh are expansion, rarefaction or destruction, trabeculation, and calcification.

The final diagnosis is always dependent on histological examination, and aspiration biopsy is recommended. A correct diagnosis was made by this method in 6 of the 7 new cases reported here.

Since these tumors show slight if any response to radiation therapy and complete extirpation of the tumor is not feasible, management is chiefly for partial control and palliation. Spinothalamie tractotomy is recommended for the control of pain. A surgical procedure consisting of colostomy, ureteroenterostomy and tumor excision has been considered, but appears unduly radical at present. Repeated surgical excisions are advised.

Since sacral chordomas are characteristically slow growing, numerous recurrences follow repeated ex-

cisions with massive invasion of the pelvis in late stages of the disease. Occasionally a single surgical extirpation results in control. Among the 38 reported cases, metastases occurred in 15, the most frequent sites being the regional and peripheral lymph nodes, lungs, liver and skin, respectively. The spheno-occipital type in striking contrast, almost never metastasizes.

C. FREDERICK KITTLE, M.D.

Some Observations on the Neurogenic Bladder  
WILLIAM F. WHITMORE, JR., AND LUIS M. ISABEL  
*N. York State J. M.* 945, 48-869.

Based on their observations of 90 patients with spinal cord injury seen in a Veterans' Administration Hospital, the authors classified the "neurogenic bladder" in each instance according to the following grouping: the numbers of patients of each type being given.

1. Normal, 2
2. Uninhibited reflex, 5
3. Reflex, normal, 48, and reflex, hypertonic, 7
4. Autonomous, 28
5. Atonic, 0.

The detailed definition of each type is given.

Ten per cent of the patients had cervical lesions; 61.1 per cent thoracic lesions and 28.9, cauda equina lesions. Both complete and incomplete cord lesions were included.

Among other observations, it was noted that 45.6 per cent of the patients developed satisfactory bladder function, while in 54.4 per cent it was considered unsatisfactory. There was a very gratifying result in general from the use of transurethral resection of the vesical neck. The authors also noted that in their patients suprapubic cystostomy is deleterious to the ultimate development of satisfactory bladder function.

JOHN MARTIN, M.D.

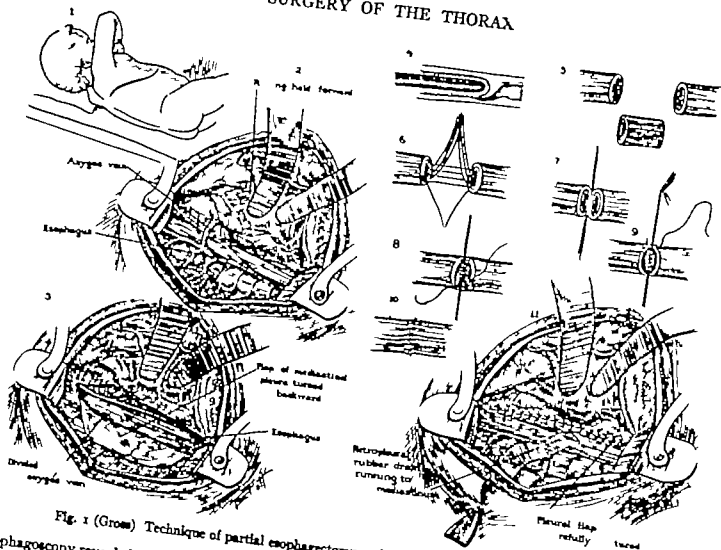


Fig. 1 (Gross) Technique of partial esophagectomy and end-to-end esophageal reconstruction.

esophagoscopy revealed obstruction of the esophagus in its middle portion. Because of marked weight loss and inability to swallow a gastrostomy was done. After a satisfactory state of nutrition was obtained, the esophagus was exposed through a right transpleural approach and a 3 cm. segment of it excised. A primary end-to-end anastomosis was done. Mediastinal and pleural drains were inserted. The postoperative course was uneventful and, when last seen the patient could swallow without any difficulty.

C. FREDERICK KITTING, M.D.

**Congenital Esophageal Atresia and Tracheoesophageal Fistula.** CLAYTON G. LYON AND STANLEY G. JOHNSON. *J. Thorac. Surg.*, 1948 17 163

Four hundred and sixty-eight cases of esophageal atresia, with or without tracheoesophageal fistula, have been reported. The anomaly has been classified under five main types:

1. The upper esophageal segment terminates in a blind pouch in the upper third, and the lower esophageal segment is represented by the presence of a similar blind pouch there being no communication with the trachea.

2. The upper esophageal segment communicates with the trachea and the lower segment is a blind pouch.

3. The upper segment terminates blindly and the lower segment of the esophagus communicates with the trachea above the carina.

4. Like type 3 but the lower segment communicates with the trachea at the carina or with the right or left main stem bronchi.

5. Both segments communicate with the trachea.

The diagnosis is suggested by increased oral secretions, attacks of cyanosis or the regurgitation of feedings. Confirmation is obtained by passage of a small catheter into the esophagus which meets an obstruction in the upper third or fails to enter the stomach. The patient is fluoroscoped while 0.5 or 1 c.c. of lipiodol is introduced through the catheter which demonstrates the upper segment with or without its tracheal communication. The inferior level of the upper esophageal segment is elevated during deglutition. After the examination, the lipiodol should be aspirated as it is easily regurgitated and enters the tracheobronchial tree. Roentgenograms of the chest and abdomen are valuable in determining the condition of the lung fields, the presence of other anomalies and the presence of gas in the gastrointestinal tract. Gas in the gastrointestinal tract is usually indicative of a fistula. Four cases are reported in which a transpleural approach with the patient under intratracheal anes-



The feasibility of excision of aortic aneurysms is based on the location of the aneurysm and the collateral circulation which is present. It is unlikely that aneurysms of the ascending aorta, aortic arch, or the first portion of the abdominal aorta supplying important visceral vessels can be excised successfully whereas short segments of the descending thoracic aorta and the distal abdominal aorta may possibly be resected and continuity restored provided methods of increasing the collateral circulation become available. The use of vein transplants to bridge aortic defects is suggested. **JAMES E. THOMPSON, M.D.**

**Primary Vascular Tumors of the Pericardium.**  
**MORRIS GREENBERG AND ALFRED AWORST, A.M.**  
*Heart J.* 1948, 35, 63.

Primary pericardial tumors are distinctly rare and are usually either sarcomas or lipomas.

Vascular pericardial tumors are even more rare. Only 5 of the reported cases can be accepted as true neoplasms. Three of these were cavernous angiomas and 2 malignant angioendotheliomas. The remainder were, in reality, examples either of vascularization in organizing blood clots or of prominent vascular channel formation in granulation tissue.

The authors report 2 cases of true primary vascular pericardial tumors. Case 1 was a small (1 cm.) benign cavernous angioma found incidentally in the sulcus between the right and left ventricles in a patient dying of peritonitis following operation for adenocarcinoma of the rectum. Case 2 was an invasive cellular angioendothelioma in a 37 year old male dying of cardiac insufficiency produced by the tumor.

No specific clinical picture for tumors of the pericardium has yet been evolved because signs and symptoms vary with the location and extent of the tumor and with the presence of hemorrhage its amount, and rapidity of occurrence. If a previously healthy person shows, without known cause, a rapid evolution of symptoms of decompensation and an enlarged cardiac shadow, a pericardial tumor should be considered. **FRANK B. QUINN, M.D.**

## ESOPHAGUS AND MEDIASTINUM

**Treatment of Short Stricture of the Esophagus by Partial Esophagectomy and End To-End Esophageal Reconstruction.** **ROBERT E. GROSS, M.D.**  
*Surg.* 1948, 3, 735

For many years the standard treatment of congenital and chemical burn esophageal strictures has been dilatation although recently there have been numerous techniques devised to establish some type of antethoracic esophagus. More recently transthoracic esophagegastrostomy has been employed. Primary end-to-end esophageal anastomosis has been regarded as technically impossible in the past, but during the last 2 years numerous successful attempts have been recorded. This method seems preferable to the more radical transthoracic esophagegastrostomy since fairly normal anatomic reconstruction is effected

and since it does not interfere with normal functioning of the stomach.

Certain technical aspects of esophageal resection and anastomosis for stricture deserve consideration.

1. The retropleural approach is advocated in children. This insures a reasonable degree of expansion of the lung and eliminates contamination of the pleural cavity during operation which gives a maximum of protection should there be any leakage during the esophageal anastomosis. It also provides a direct route for external drainage if suppuration or esophageal leakage should occur postoperatively. In older subjects a transpleural route is preferable.

2. Mobilization of the esophagus is accomplished more easily on the right than on the left side. A right sided incision will not permit the stomach to be drawn up into the thoracic cavity but unless it can be definitely determined before operation that an esophagegastrostomy will not be necessary the left approach should be used.

3. Many different types of incision have been advocated, but in general a long intercostal one is best provided it is located exactly at the level of the lesion. In older patients in whom the costal cage is less yielding it may be necessary to divide several ribs posteriorly.

4. Since reconstruction of the protective bulkhead between the mediastinum and pleural cavity is important, great care must be taken to preserve the parietal pleura covering the esophagus. The longitudinal opening of this layer should be made anterior to the esophagus so that a broad flap can be raised and sutured over it after anastomosis has been performed.

5. The esophagus must be widely mobilized to accomplish its anastomosis without undue tension. Although its poor vascularity has been commented on extensively in the past, the author states that the entire intrathoracic portion may be freed without subsequent damage if this is necessary for resection and reconstruction.

6. Inspection of the esophagus externally may give little clue to the location of the stenotic lesion. For accurate localization a catheter is inserted by the anesthetist and pushed to the constricted region.

7. The esophageal anastomosis is sutured in two layers with No. 5-0 silk the outer layer including the muscularis and submucosa, the inner the mucosa. Crushing of the phrenic nerve does not appreciably facilitate the operation.

8. A soft rubber drain is inserted into the mediastinum through a stab wound in the back to provide for any postoperative mediastinal suppuration.

9. A rubber catheter is placed into the pleural cavity routinely to allow suction and insure evacuation of the pleural cavity.

10. The establishment of a gastrostomy is advisable to allow for adequate nutrition and to permit healing of the esophageal anastomosis during the early postoperative period.

The case of a 11-month-old boy with intermittent vomiting since birth is presented. Barium studies and

operation an esophageal pouch was found and a fistula between the distal esophagus and right main bronchus was ligated. The gap in the esophagus was too great for direct anastomosis. The second operation was a gastrostomy. At the third operation the superior mediastinum was entered and the blind end of the esophagus freed and brought out through the chest wall. It was opened a days later. The construction of the esophagus was then done in stages forming a skin lined tube. The procedure consisted of forming two separate skin lined flaps one attached to the esophagostomy opening and one to the gastrostomy and later attaching these together. Feeding by mouth was begun right away. A constriction was found at the gastrostomy opening which was corrected by operation.

From a pediatrician's viewpoint, the operation of choice when possible, is primary anastomosis. The multiple stage operation with or without a jejunal segment or a free jejunal transplant is a formidable amount of surgery and has psychological implications for the patient. The multiple stage operations require extensive hospitalization with exposure to infection and a tremendous utilization of hospital services.

With all these facts in mind the possibility presents itself of the advisability of performing a primary anastomosis with a thoracic stomach when the segments cannot otherwise be approximated with safety. This operation has been attempted in infants by Singleton and might be considered in suitable cases.

LOUIS T. BYARS, M.D.

#### Esophageal Hiatal Herniae of the Short Esophagus: Types, Etiologic and Therapeutic Considerations. ARTHUR M. OLSEN and STUART W. HARRINGTON. *J. Thorac. Surg.*, 1948 17, 189.

A study was made of 220 patients with short esophagus and a partial thoracic stomach seen at the Mayo Clinic. On the basis of this review the following conclusions were drawn and observations made.

True congenital short esophagus is rare (4 per cent of the cases in the authors series). In an overwhelming majority of the cases shortening of the esophagus was acquired in the later years of the patient's life.

Basic anatomic factors in the development of hiatal hernia are congenital enlargement of the esophageal hiatus of the diaphragm and atrophy or weakness of the diaphragmaticoesophageal membrane.

Shortening of the esophagus develops as a result of peptic ulceration of the esophagus. Peptic ulceration of the esophagus may be the result of (1) excessive or prolonged vomiting or (2) incompetence of the physiologic sphincter at the cardia, when it occurs in association with hiatal hernia or with reflex spasm of the lower part of the esophagus. Reflex spasm of the esophagus is the result of stimulation of the vagus nerve and may be produced by a variety of digestive disorders.

Dysphagia is the most common symptom associated with the short esophagus. In early stages spasm may be the cause of dysphagia. However, organic stenosis of the lower part of the esophagus develops in most cases.

Hiatal hernia of the short esophagus type is not favorable for surgical treatment. When dysphagia is present dilatation may be carried out by passing sounds over a previously swallowed thread. Medical measures are directed against further ulceration of the lower part of the esophagus.

Because the treatment of the short esophagus type of hernia is radically different from that of the usual hiatal hernia it is important that an accurate diagnosis be made. Careful roentgenoscopic studies are necessary and esophagoscopy examination is frequently required if hiatal hernias of the short esophagus type are to be differentiated from hiatal hernias with an esophagus of normal length.

#### Preoperative, Operative, and Postoperative Care in Esophageal Resections. HERBERT C. MAIER. *Surgery* 1948 23, 884.

Recent advances in the reduction of morbidity and mortality following radical resection of the esophagus for carcinoma have been due to better preoperative preparation of the patient, improvements in anesthesiology, chemotherapy, a better understanding of the physiological alterations during and following operation, improved surgical technique, and better postoperative care.

**Preoperative preparation of the patient.** Because of the obstructive changes usually present in varying degrees, the esophagus should be cleansed above the tumor. All retained material and secretion should be aspirated and daily lavage of the esophagus instituted. Care should be taken that no aspiration into the lungs occurs. The importance of good mouth hygiene is emphasized. It is preferable to correct nutritional deficiencies if possible through feeding by mouth together with supplementary parenteral injections, rather than to perform a preliminary jejunostomy. Gastrostomy is to be avoided in any case in which the stomach requires mobilization at the time of the esophageal resection. The correction of the hypoproteinemia as well as the other nutritional deficiencies may require a week or two. A fluid diet or if feasible a soft diet high in proteins, carbohydrates, and vitamins is given. In some cases preoperative blood or plasma transfusions and amgen are indicated. Vitamin C deficiency should be corrected by a daily dose of from 200 to 1,000 mgm. of ascorbic acid parenterally. Transfusions are given if the hemoglobin is less than 80 per cent after dehydration is corrected.

The preoperative work up should also include an evaluation of the cardiac and renal status. Preoperative digitalization may be indicated. Any clinical or laboratory evidence suggesting coronary sclerosis requires constant effort to avoid anoxia at all times during and following operation. The presence of emphysematous lungs is important since

thema was employed. The operative procedure is given in detail. **SAMUEL KAHN, M.D.**

**A New Method of Restoring Continuity of the Alimentary Canal in Cases of Congenital Atresia of the Esophagus with Tracheoesophageal Fistula not Treated by Immediate Primary Anastomosis.** **RICHARD H. SWEET, Ann. Surg. 94, 7 757**

It has been shown by Ladd and others that in many suitable cases of congenital atresia of the esophagus with tracheoesophageal fistula it is possible to close the fistula and perform an immediate primary esophageal anastomosis. In other cases in which primary anastomosis is impossible, cervical esophageotomy and gastrostomy are established as lifesaving measures. In the latter types of patients it is possible to create an external esophagus by various multiple-stage time-consuming maneuvers, the results of which on the whole have been discouraging. The author describes a new method whereby continuity of the alimentary tract can be restored in this group of patients with previous cervical esophageotomy and gastrostomy by carrying out an intracervical esophagogastric anastomosis after pulling the stomach up through the chest.

The operation is performed in one stage with three steps. The first step is carried out through a left-sided eighth-rib transthoracic approach. The entire stomach to the level of the pylorus is mobilized by cutting the gastroduodenal and gastrophrenic ligaments and all vessels except the right gastric and right gastroepiploic, with care to avoid injury to the vascular arcades. The rudimentary distal stump of the esophagus is removed and the gastrostomy opening is closed. The fundus of the stomach is pulled up into the chest posterior to the hilum of the lung and temporarily anchored at the apex. The chest is then closed and the patient turned onto his back. In the second step a vertical incision is made in the left side of the neck, the esophagotomy is mobilized and the lower portions of the clavicle and first rib are resected. The apex of the thorax is thus entered and the stomach pulled out into the neck. Esophagogastric anastomosis is then carried out with three layers of interrupted silk sutures, as described by the author previously. The final step is the closure of the abdominal-wall portion of the gastrostomy.

The case of a 21 month-old infant treated successfully by this method is reported in detail. At the latest follow-up the patient was eating a diet normal for his age, was gaining weight slowly and had no obvious physiologic disturbances resulting from the displacement of his stomach through the chest into his neck.

The method was also employed successfully in a 56-year-old man to resect a carcinoma of the esophagus situated behind the manubrium of the sternum, a level too low for a Wooley procedure and too high for transthoracic esophagectomy with high intra-thoracic esophagogastric anastomosis.

**JAMES E. THORNTON, M.D.**

**Construction of Skin Tube Esophagus following Surgical Treatment of Tracheoesophageal Fistula.** **ROBERT H. IVY, H. R. HAWTHORNE, and JOSEPH A. RITTER. Plast. Reconstr. Surg. 94, 3 73**

Various procedures have been proposed for reconstruction of the esophagus following resection for structure due to caustic burns, malignant disease, or congenital anomalies. Where the gap is sufficiently small, direct anastomosis of the free ends may be possible. In other cases an epithelium-lined tube of transplanted tissue must be used to restore the continuity. This has been accomplished intrathoracically by carrying a segment of jejunum or a tubed portion of the stomach up to meet the upper stump of the esophagus. Extrathoracic methods comprise the formation of an epithelium-lined tube beneath the skin of the anterior chest wall, connected above with the opening in the neck of the upper stump of the esophagus and with the gastrostomy below.

In 1917 Esser made an anterior thoracic esophagus by tunnelling beneath the skin of the chest and inserting a large rubber tube covered with Thiersch skin grafts. The ends of this epithelium lined tube were later connected with the esophageal opening above and the stomach below.

In 1941 Davis and Stafford reported a case of stenosis of the esophagus following lye burns. After the preliminary operations of gastrostomy and formation of a fistula of the upper stump of the esophagus in the neck the extrathoracic esophagus was constructed by the formation of a tube lined with inverted skin extending from the upper fistula down toward the gastrostomy opening, a tubed pedicle flap from the side of the body being used for covering. The lower end of this skin-lined tube was later joined to the stomach by a segment of jejunum.

Longmire and Ravitch employed, for the lining of the tube, a loop of jejunum ultimately completely isolated from its mesenteric blood supply. In several stages with successive severance of the vessels supplying it, the segment of jejunum was implanted in the skin tube, so that it finally was completely cut off from its original blood supply. The jejunum-lined skin tube was then transferred to the anterior chest to serve as a channel between the upper part of the esophagus and the stomach.

Ladd reports an extensive experience with esophageal atresia and tracheoesophageal fistula. Of 34 patients, 11 are still living after various operations. In 2 of these direct anastomosis was possible, in 2, the anterior thoracic esophagus was completed, and in a third patient it was in process of construction the remaining 6 patients were all doing well and awaiting construction of an anterior thoracic esophagus.

In a more recent paper published in January 1947 Ladd and Swenson discuss the subject further. They recommend attempted direct anastomosis if the gap is not more than 2 cm.

In the case reported, the technique described by Ladd was followed as closely as possible. At the first

time of esophagoscopy routine bronchoscopy has been done on 4 occasions the tumor was found to invade the left stem bronchus or trachea which obviated the necessity for exploration.

The preoperative preparation the operative technique and the postoperative complications are discussed in detail.

SAMUEL KAHN, M.D.

#### Mesothelial Mediastinal Cysts (Pericardial Cysts)

Differential Diagnosis of Shadows Continuous with the Anterior Inferior Mediastinum.  
GEORGE COOPER, JR., VINCENT W. ARCHER, and JOHN R. MAFF *South M J* 1948 41 285

A circumscribed homogeneous shadow projecting from the anterior inferior mediastinum and continuous with the shadows of the diaphragm and anterior chest wall is most apt to represent a mesothelial mediastinal cyst.

A number of other conditions benign and malignant cannot be ruled out without biopsy.

Demonstration of such shadows is indication for exploratory thoracotomy JOHN J. MALONEY M.D.

#### MISCELLANEOUS

Spontaneous Mediastinal Emphysema and Spontaneous Pneumothorax; a Report of 20 Cases.  
HELEN A. DICKIE. *Ann. Int. M* 1948, 28 618.

That spontaneous mediastinal emphysema is not a rare condition is indicated by the rapidly increasing number of case reports in the literature. Quite commonly there is an associated spontaneous pneumothorax. Over a 4 year period 20 cases of pneumothorax or a combination of the two were diagnosed among students seen at the University of Wisconsin Student Health Service. In 6 cases pneumothorax alone was present, 7 individuals showed mediastinal emphysema without pneumothorax and in 7 patients both conditions were present.

The mechanism of the production of a spontaneous pneumomediastinum is obscure and the usual explanation is that air from a ruptured alveolus in the lung has caused dissection along the perivascular sheath to the mediastinum. The experimental work of Macklin with cats showed the associated pneumothorax to be caused by a rupture of the mediastinal pleura with the resultant escape of air into the pleural space. The frequent association of the two states as seen clinically suggests that this same mechanism may occur in the majority of spontaneous pneumothoraces seen in otherwise healthy individuals. The reason for the distention and rupture of the alveolus is not known there is usually no history to suggest increased intrabronchial tension preceding the onset. In many of the cases the student was sitting in class or at study when the rather dramatic symptomatology suddenly ensued.

Characteristically the onset of spontaneous pneumomediastinum is sudden with pain of varying severity felt substernally with radiation to the back neck shoulder or occasionally as in angina pectoris to

the little and ring fingers of the left hand. In about half of the cases peculiar noises over the precordium are audible to the patient. On examination a crunching sound which varies with the phase of respiration or with changes in position is heard over the precordium. Often this sound is similar to that of pericardial friction rub. Hyperresonance over the precordium is a constant finding.

In only 3 of her 14 cases could Dickie demonstrate mediastinal air by means of roentgenograms or the fluoroscope, even with repeated examinations in various positions. Unless the mediastinal air is large in amount or is localized there is insufficient contrast with the air-containing structures about the mediastinum to make it visible this difficulty is further increased by the associated pneumothorax which is commonly on the left side.

Electrocardiograms show no constant pattern for mediastinal emphysema with or without pneumothorax, but are of value in excluding the more serious conditions, such as coronary occlusion or pericarditis, which have a similar syndrome.

The disease runs a benign course, and treatment in the main is purely symptomatic. Cough should be controlled but sulfonamides or antibiotics as prophylaxis against mediastinitis are not recommended. When the acute symptoms of mediastinal air have subsided the patient is treated on an ambulatory status. Because of the alarming onset of the condition patients must be reassured that they have no serious cardiac or pulmonary pathology.

WAYNE F. CAMERON M.D.

Congenital Diaphragmatic Hernia: Anatomic and Surgical Importance of the Left Triangular Ligament of the Liver PHILIP THOREK *Arch Surg.* 1948, 56 238.

A not uncommon lesion in the newborn is diaphragmatic hernia. Morgagni (1769) was the first to give this subject serious consideration although Paré had reported 2 traumatic instances as early as 1610. Case reports now number in the thousands. The relative increase in frequency appears to be due to better diagnostic methods and the consideration by clinicians of its existence.

Since elements of the adult diaphragm are derived from several embryological sources, various defects are possible according to the location and extent of the developmental anomaly. The following classification is given:

1. Herniation through the posterolateral portions of the diaphragm along the embryonic pleuropertoneal canal (foramen of Bochdalek). This is the most common location the left side is involved four times as frequently as the right.

2. Herniation through the esophageal hiatus due to lack in development of one or both diaphragmatic crura.

3. Herniation through the retrosternal area (foramen of Morgagni). This is a herniation through the region of the retrosternal attachments of the diaphragm and is the least common type.

slight changes in pulmonary expansion in the emphysematous individual may lead to respiratory insufficiency with resultant anoxia, which may in turn bring about cardiac complications. With recent advances in anesthesiology preoperative pneumothorax does not seem advisable for esophageal surgery. Preoperative penicillin therapy is usually begun from 24 to 48 hours prior to operation. Before operation, a Levin tube is introduced through the nose and placed in the esophagus so that the end of the tube is just above the site of obstruction.

*Care of the patient during operation.* The fundamental principles are (1) the avoidance of obstruction of the airway and adequate oxygenation throughout the operation (2) adequate blood and fluid replacement throughout operation (3) minimizing reflex disturbances in the operative field by the avoidance of unnecessary trauma (4) minimizing contamination of the operative field, (5) maintenance of an excellent blood supply and avoidance of tension at the site of anastomosis (6) periodic inflation of the lung during the intrapleural part of the operation, and (7) complete re-expansion of the lung as the pleural cavity is closed. In any case in which there is even a suspicion that the opposite pleural cavity may have been entered a roentgenogram of the chest is taken in the operating room at the conclusion of the operation and inspected at once. If this shows any appreciable degree of pneumothorax, aspiration of the air with a syringe fitted with a three way stopcock and connected to a manometer is indicated. Closed drainage is instituted on the side of the operation.

*Postoperative care.* In the experience of the author, hypoproteinemia has occurred following esophageal resection in spite of plasma transfusions, blood transfusions, antigen, or other protein derivatives administered parenterally. Perhaps the hypoproteinemia resulting from delayed feeding entails more leakage from the suture line than would occur if feeding were started early by mouth. Therefore in addition to giving plasma, blood transfusion and liberal doses of vitamin C postoperatively the author begins feeding by mouth within 1 or 2 days of operation. Repeated plasma protein determinations are important.

The length of time the drainage tube is left *in situ* depends upon (a) the completeness of pulmonary expansion (b) the thoroughness of evacuation of air and fluid from the pleural space, (c) whether the tube is still functioning or has been sealed off inside the thorax, and (d) whether the tube *in situ* would be a factor of safety should complications develop in the region of the anastomosis. It is obvious that the drainage must be kept airtight at least during the first week after operation if drainage has to be maintained for this long a period of time. When the tube is withdrawn, the withdrawal must be rapid, with immediate tying of the previously placed mattress or purse-string suture to close the opening.

The principles which must be observed to reduce postoperative cardiac complications are (1) avoidance of anoxia at all times, (2) avoidance of any in-

terference with pulmonary ventilation, (3) avoidance of any appreciable drop in the blood pressure (4) reduction of vasospastic factors as far as possible, (5) avoidance of an increased tendency toward intravascular clotting due to changes in the blood constituents and blood flow. Digitalis has an important place in the postoperative therapy.

The principles to observe in avoiding reduction of bronchial secretion are (1) proper nursing assistance with manual support of the area of incision during coughing, (2) proper use of sedation with avoidance of undue pain, and (3) the early use of intratracheal suction if voluntary cough is impossible or ineffective. If these measures are followed, bronchoscopy which is also an important therapeutic measure will be necessary only occasionally. Therapeutic bronchoscopic aspiration should be employed with no hesitation. Bedside roentgenograms should be taken frequently in the postoperative period if it is thought that they might give information of value in the diagnosis and management of pulmonary complications.

Whether or not it is advisable to introduce the Levine tube past the gastroesophageal anastomosis into the intrathoracic portion of the stomach at the time of operation is a moot point.

Oxygen therapy either through tent, nasal catheter or mask, should be given to every patient. Early ambulation should be encouraged as much as possible and leg exercises in bed can be performed until the patient is allowed up.

HAROLD LAUFMAN M.D.

**Surgical Management of Carcinoma of the Lower Two-Thirds of the Esophagus and Cardiac End of the Stomach.** JOHN W. SNEDECOR. *J. Thorac. Surg.* 9:48, 7:143.

The experience with 72 operations on 71 patients with carcinoma of the esophagus, occurring at or below the arch of the aorta and of the cardiac end of the stomach is presented.

The youngest patient who had a successful resection was 52 years old, the oldest was 84. The general condition of the patient, especially the condition of the cardiovascular system is of more importance than the chronological age. Involvement of the cervical lymph nodes is relatively rare, except in lesions high in the esophagus. In lesions below the arch, the lymphatic drainage tends to the periesophageal and the subphrenic regions, and to the nodes in the region of the celiac axis and left gastric arteries.

Metastatic lesions in the lungs and pelvis should be carefully sought. Involvement of the liver is a late manifestation. The tendency for primary esophageal lesions to spread in the wall of the esophagus is known, so that a wide excision of the tumor should be made when possible.

Esophagoscopy with positive tissue biopsy is almost always possible in cases of cancer of the esophagus, and is frequently possible when the esophagus is involved by high gastric cancer. At the

# SURGERY OF THE ABDOMEN

## ABDOMINAL WALL AND PERITONEUM

### Floss-Silk Lattice Repair for Inguinal Hernia RODNEY MALINGOT *Lancet* Lond. 1948 1 861

The author has used a floss silk posterior lattice repair operation exclusively (Fig 1) on all patients with a direct inguinal hernia encountered during the past 10 years. The same procedure was adapted for large oblique hernias in which the internal ring and the floor of the inguinal canal had been unduly stretched or in which the muscular and fascial supports appeared to be weakened and atrophied, as well as for certain types of recurrent inguinal hernias, particularly in enfeebled patients.

The immediate and late results were classed as excellent. Among the last 100 cases sepsis developed in only 2 patients but on removal of the offending ligatures and with penicillin therapy healing was satisfactory. Sepsis most often occurred in obese patients in the aged and in patients who had had 2 or 3 or even more herniorrhaphies. Avoidance of supplementary operative procedures such as those for varicocele and hydrocele during operation on a hernia, as well as operation on only one side at a time has cut down complications.

STEPHEN A. ZITMAN M.D.

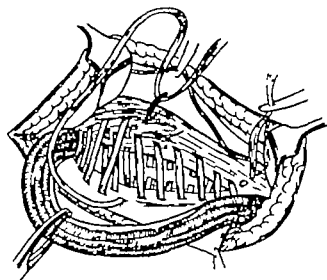


Fig 1 (Malingot) Floss-silk lattice repair for inguinal hernia.

Gastritis preoperative or postoperative is an important complication of gastric surgery

RICHARD J. BENNETT JR., M.D.

### On Gastric Myoma and Fibroma SAKARI TIMONEN *Ann. chir. gyn. fenn.*, 1948, 37 52

The author presents 3 cases of benign tumors of the stomach which were removed at operation. The first was a benign bleeding myoma, the second a fibroleiomyoma or stenosing type of myoma, and the third a fibroma showing no serious symptoms. These were all benign nonepithelial gastric tumors.

A reliable diagnosis was not made postoperatively in any of the cases, which is not unusual for these tumors. Histological diagnosis offers difficulties in determining the type of tumor and in ruling out malignancy. For these reasons, gastric resection is recommended as the proper surgical procedure.

STEPHEN A. ZITMAN M.D.

### Carcinoma of the Stomach CLAUDE E. WELCH and ARTHUR W. ALLEN *N. England J. M.*, 1948 938 583.

A study of all the patients with carcinoma of the stomach admitted to the Massachusetts General Hospital Boston during the 10 year period from 1937 to 1946 shows that the delay before treatment has remained unchanged, an average of 5 months. However the more aggressive attitude toward gastric ulcer has increased the recognition of early cancer of the stomach.

The introduction of a transthoracic approach and the wider use of total abdominal gastrectomy have increased the number of cases available for resection.

The mortality for gastric resections for cancer has dropped to a present level of 17 per cent for the entire series and to 11 per cent in the last 5 year period.

## GASTROINTESTINAL TRACT

### Observations on the Etiology of Postoperative Gastritis. EDDY D. PALMER. *Gastroenterology* 1948, 10. 671

It is suggested that gastritis is more important postoperatively than is an anastomotic ulcer. Vomiting, bleeding, weight loss and pain aggravated by food are the more important complaints.

The author's material consists of 24 cases. There was a rigid selection of cases with elimination of the cases which included any complicating factors. The patients included 1 woman and 1 negro. Their ages varied from 19 to 66 years. Four had a simple gastrotomy or gastrostomy, 1 had an esophagogastrotomy, 8 had gastrojejunostomies, and 11 had subtotal gastric resections. All of the patients were hospitalized for study. Complete work ups were carried out and a rather rigid routine was adhered to. Six tables are presented in detail.

It was found that most postoperative chronic gastritis represents merely the continuation of preoperative gastritis, with or without surgical aggravation. Chronic gastritis which is due to surgery is of the superficial atrophic type. The secretory activity of the stomach plays little or no part in the postoperative development of gastritis. In cases in which there is rhythmic activity of the stomach gastritis may still develop.

Modern resection technique apparently did not prevent the development of postoperative gastritis.

Herniations through the aortic and vena caval openings have not been reported. A diaphragmatic hernia may or may not have a sac limiting its superior border.

Congenital diaphragmatic hernias produce symptoms manifested by the respiratory, circulatory and intestinal systems, according to the viscera interfered with and the severity of displacement. Any newborn who displays cyanosis, dyspnea, and vomiting or any combination of these should be suspected of having a diaphragmatic hernia. Symptoms vary greatly in degree from intermittent attacks of vomiting, cyanosis, respiratory difficulty and vague dyspnea to constant distress with any of these.

Physical findings of a congenital diaphragmatic hernia are usually limited to increased pulse and respiratory rates although the affected side may be less mobile and there may be some dullness to percussion or tympany, according to the viscera present within the chest. The diagnosis is established by roentgenological examination of the chest. Although the viscera forming the hernia can usually be determined with ordinary x rays, a barium swallow is necessary in some instances.

The treatment of this condition is surgical. The earlier such patients can be operated on, the less distention and enlargement there will be of the intestinal viscera within the chest. Preoperative measures are designed for deflation of the alimentary tract, the establishment of proper hydration, and prophylactic chemotherapy. Although a trans-thoracic approach is best in adults, the abdominal

route is superior in infants. The author emphasizes the importance of the left triangular ligament of the liver. This is a bloodless fold of peritoneum, of which severance permits mobilization of the left lobe of the liver to the right with immediate visualization and adequate exposure of a hiatal hernia. Positive pressure anesthesia is essential. After the abdominal viscera have been reduced from the thoracic cavity, the hernial sac, if one is present, should be excised and sutured and the diaphragmatic defect repaired. Usually this is best accomplished by interrupted cotton sutures. Closure of the abdomen may be difficult, and interrupted through-and-through sutures are suggested rather than a closure by layers.

Postoperative care should include blood transfusion, oxygen therapy, early oral feeding, chemotherapy and frequent chest roentgenograms.

The case of a 7 weeks old female infant with congenital diaphragmatic hernia through the esophageal hiatus is presented. The herniation was due to non-development of the left crus of the diaphragm. The symptomatology was that of cyanosis, convulsive seizures and postprandial vomiting. Physical examination revealed moderate cyanosis, decreased expansion of the left side of the chest, and hyperresonance of the right chest with tympany in the lower portions of the left chest. The left border of the heart was at the right midclavicular line. Roentgenological findings diagnosed a diaphragmatic hernia. The child was operated on successfully with an uneventful postoperative period.

C. FREDERICK KITTLE, M.D.

Pneumonitis was the most frequent complication. There appeared to be close correlation between the severity of malnutrition and the incidence of pneumonitis in these patients, in that 41 of the 47 patients gave evidence of extreme weight loss, anemia, and hypoproteinemia. Twelve of these 47 patients had congenital esophageal atresia with tracheoesophageal fistulas. This primary lesion may well have contributed to the incidence of pneumonitis.

The incidence of phlebotrombosis or thrombophlebitis and pulmonary embolism can be explained only by the failure of the attending physician to look for or find evidence of venous thrombosis in the lower extremities.

A palliative gastrostomy in patients with inoperable malignant neoplasms or other hopelessly incurable lesions produces no significant extension of life and no demonstrable nutritional improvement.

Since neither life expectancy nor outstanding nutritional improvement is to be gained by palliative gastrostomy, the use of this procedure for hopelessly incurable lesions must depend upon the surgeon's judgment as to the degree of physical and mental satisfaction which will be gained by such an operation for each patient.

Gastrostomy in patients with non-neoplastic curable lesions of the hypopharynx, esophagus and esophagogastric junction serves admirably as a means of furthering the local treatment of these areas. When the nutritional need is great in these patients, the nutritional response is maximal only when the gastrostomy feeding is supplemented by an oral diet.

A satisfactory state of nutrition is best maintained in esophagectomized patients when they are able to ingest a diversified diet through either an artificial or a surgically reconstructed esophagus.

HARRY W. FINEK, M.D.

**Hypertrophic Pyloric Stenosis in the Adult (Stenosi pylorica hypertrofica dell'adulto)** RAFFAELE MAZZETTI.  
*Gior. ital. chir.* 1948, 4, 65.

The case reported by Mazzetti occurred in a woman 44 years of age who had been in good health until the age of 25 when the first gastrointestinal disturbances appeared on the occasion of her first pregnancy and persisted for about 3 months after delivery. She was then well for 2 years, after which the symptoms recurred. Three years later during her second pregnancy the symptoms became worse and persisted since then with the exception of rare and short intervals. The symptoms consisted of epigastric heaviness, moderate pain, slow and difficult digestion, frequent eructations and sometimes nausea and vomiting. Gradually the patient has lost considerable weight. For the last 3 months her symptoms had been worse and the resulting anorexia reduced her to complete inactivity. Sedative treatment afforded no relief.

On admission the abdomen was not painful on superficial palpation, the stomach was partially filled with fluid. Roentgen examination revealed a picture

of gastric ptosis with marked delay in emptying. Laparotomy disclosed a dilated stomach with a strongly hypertrophic pyloric ring and stenosis. There was moderate perigastritis and periduodenitis at the posterior aspect. A Hoffmeister Finsterer gastric resection was performed. The histologic diagnosis was hypertrophy of the pylorus.

It was difficult to establish with certainty what the real cause of the hypertrophy of the pylorus had been. It could not be attributed to an inflammatory process or to ulceration because the histologic examination excluded this possibility. The mild perigastritis and periduodenitis had to be considered secondary to the hypertrophy because these irritative conditions were too slight to have determined such a conspicuous hypertrophic change. Besides these conditions are encountered rather frequently and have a silent course, while pyloric hypertrophy is rare.

It seemed probable that the present case like other similar ones represented a congenital hypertrophy which had long remained latent and had been stimulated by the occurrence of a banal gastritis during pregnancy. That the gastric disturbances were the contributing factor was suggested by the fact that they were the only data worthy of consideration in the history of the case. In addition, other authors have reported that mild gastritis is capable of making manifest a latent state of hypertrophy.

The correct diagnosis was made only at operation. Gastric resection was favored because the condition of the patient allowed it and only a radical operation affords protection against possible recurrence and malignant degeneration. When the patient was seen 10 months after operation she had gained considerable weight, had not had any more digestive disturbances, and was in good general condition.

RICHARD KEMEL, M.D.

**Reduction of Intussusception by Hydrostatic Pressure—An Experimental Study** MARK M. RAVITCH and ROBERT M. McCURRY JR., *Bull. Johns Hopkins Hosp.* 1948, 81, 550.

This work was undertaken in order to determine experimentally the likelihood of perforation when intussusception is reduced by hydrostatic pressure. The intussusception was produced in dogs by stimulating a portion of the terminal ileum with a faradic current from an induction coil, seizing it with rubber-shod forceps while still contracted and inverting it into the distal segment. If the entire intussusception was produced in this manner the serosal surfaces were sufficiently traumatized so that firm adhesions developed within 12 hours which made reduction impossible by hydrostatic pressure and difficult by direct manipulation. Therefore in subsequent animals the intussusception was initiated in this way with forceps and continued the rest of the distance with a smooth glass rod. Intussusceptions of 15 cm. in length were regularly produced.

It was shown that except in one animal whenever an intussusception could be reduced by hydrostatic pressure the animal survived indefinitely.



The mortality of subtotal resections in which all gross disease is removed has been 3 per cent in the last 5 year period.

The number of patients not subjected to operation has declined. Seventy five per cent have an operation. Fifty per cent of the total have a gastrectomy either subtotal or total.

The best palliative operation if gross disease can not be removed is subtotal gastrectomy.

The 5 year survival rate is now 7 per cent of the entire group that enters the hospital.

The best method now available to increase the number of cures of cancer of the stomach is to reduce the delay from the onset of symptoms to the surgical intervention.

CHARLES BARON, M.D.

**The Problem of Gastric Cancer in a University Hospital.** *II GLENN BRILL, Surgery 1945, 3 35*

This brief statistical study from the University of California Medical School presents figures in substantial agreement with those from similar institutions.

There were 540 patients with carcinoma of the stomach of whom 60.2 per cent were operated upon, and 34.4 per cent of the total were resectable. Therefore, in 65.5 per cent or approximately two-thirds of the patients seen a curative type of surgery could not be attempted.

The lesions at the pyloric end of the stomach accounted for more than 90 per cent of the cases resected. Of the 157 patients with lesions at the pyloric end 14 (8.9 per cent) were alive longer than 5 years and 30 others were alive but had not yet reached the 5 year period. Other lesions of the stomach offered less hope since of the patient being alive after 5 years however, of 40, 8 were alive but had not yet reached the 5 year period.

The operative mortality dropped from 32.2 to 1.0 per cent in the last 5 years.

The point stressed are that better training of all physicians and earlier diagnosis or examination for cancer of the stomach could increase the number of cases suitable for resection and that doctors and laymen should be acquainted with the cure rate in cancer of the stomach so that they will not blindly accept a fatalistic attitude when the diagnosis is made.

FREDERICK C. HOSKIN, M.D.

**Total Gastrectomy with Esophagoduodenal Anastomosis.** *JAMES T. PRITCHETT and FRANK KERN, Ann Surg 1945, 50, 45.*

The purpose of this article was to draw attention to one method of restoration of gastrointestinal continuity after complete removal of the stomach, which has received little consideration in recent years.

Interest in this subject, on the part of the authors, is stimulated by a recent case in which the pathologic process and anatomic relationships were such that the duodenum could be readily anastomosed to the esophagus after removal of the entire stomach.

Previous experience with esophagoduodenal anastomosis after total gastrectomy was mentioned briefly.

The 2 cases in which this type of operation was

performed recently are presented. It was concluded that this procedure is suitable only in a selected group of patients. The technique of operation is briefly described. Esophagoduodenostomy is considered advantageous when practical because of its comparative simplicity and the elimination of unnecessary suture lines, and also because of the more nearly normal anatomic and physiologic restoration of gastrointestinal continuity which results.

**Gastrectomy.** DONALD R. COOPER and ROBERT W. BUCKTON, *Surgery 1945, 23, 811.*

Gastrectomy, as a measure for the control or improvement of the nutrition of ill patients, has long been a standard surgical procedure carried out upon selected patients. In a recent editorial, however, it was indicated that the life expectancy of the majority of patients upon whom this procedure is carried out is little or possibly adversely affected by this operation.

The performance of gastrectomy is one of the earliest of surgical procedures. Because of some of the technical difficulties encountered in carrying out this simple operation or because of the subsequent unsatisfactory functioning of the gastrectomy many methods and variations have been advocated by various surgeons. At the present time the fashioning of a gastrectomy is varied by each surgeon to meet the needs of a particular situation and little importance is attached to the use of difficult or elaborate techniques. Since many gastrectomies are considered temporary expedients and not permanent fistulas, the simpler procedures are believed to be most suitable. In many instances, because of the poor general condition of the patients, the simplest procedure carried out under local anesthesia is obligatory.

In attempting to correlate the surgical complications and the difficulties entailed in the postoperative feeding regimes a detailed examination of each complication in relation to the surgical technique used was made. The percentage of complication encountered in each instance was, with one exception, without significant difference. A significantly greater number of patients experienced stomal malfunction after the Stamm type of gastrectomy.

Again the type of anesthetic agent was implicated in the production of increased morbidity and mortality rates. In each case the anesthetic agent in a series of patients was chosen to meet the qualifications of the patient and the requirements of the surgeon. In a group of 194 patients, gastrectomy was carried out 109 times with local procaine infiltration anesthesia, 79 times under general inhalation anesthesia, and 6 times with spinal anesthesia. No clear-cut correlation between postoperative complications or death and the incorrect choice of anesthetic was noted.

In 82 patients (42 per cent) of the 194 upon whom gastrectomy was performed no postoperative complications occurred. In the remaining 112 patients a total of 147 complications occurred.

**Modern Trends in Surgery of the Colon** MORRIS BERENSON and ALBERT BERENSON *Surg Clin. N. America* 1948 28 525

The authors have discarded the Mikulicz operation except in those patients with absolute intestinal obstruction. Its undesirable features are that it is a staged operation and that it requires long hospitalization with its attending economic strain on the patient. Notwithstanding the fact that it is one of the safest operations to perform on the colon, the disadvantages as cited are so great that it has been replaced by other simpler and less time-consuming procedures.

The newer procedures have been made possible by better knowledge of the physiology anatomy and the application of chemotherapy before and after operation. This knowledge is applied in the form of preoperative and postoperative precautions which must be adhered to so that the best results may be obtained. The operation, dependent upon the anatomicopathological location of the tumor is described. The one-stage resection and primary anastomosis of the colon when the lesion is proximal to the rectosigmoid junction is strongly recommended. Even here when the colon and lesion can be mobilized it may be possible to perform this operation. Beyond the rectosigmoid junction the Miles operation is employed. The Babcock Bacon operation having proved less satisfactory in the author's hands.

Old age is not considered a deterrent to operation for cancer of the colon. The case of an 85 year old patient is discussed as also is a case of melanosis of the colon exhibiting the same symptoms as were found in carcinoma of the colon.

STEPHEN A. ZIEGLER M.D.

**Factors Influencing the Healing of Anorectal Surgical Wounds.** JOHN MCGRAWY *South. M. J.* 1948, 41 401

The factors which influence the healing of anorectal wounds are the general condition of the patient, rest of the part, the presence of foreign bodies in the wound, the blood supply, incomplete removal of the lesion, infection and the behavior of the wound.

There are two principal forces acting upon wounds in this area—one in a medial and cephalad direction and one in a side-to-side fashion. If a surgical wound in this region is of such a character that the medial and cephalad forces acting upon it predominate, there will be a great tendency for the outer extremity of the wound to be drawn into the anal canal, with the likelihood of its becoming undermined with resultant postoperative sinus and abscess formation. This is particularly true when the wound is located in the anterior or posterior commissures of the anus where the fibroelastic extensions are much more numerous. If a sinus or an abscess develops in the wound the prolonged infection leads to the formation of an excess of scar tissue and a delay in the covering of the wound with epithelium. In order to avoid this complication surgical wounds of this area should always be extended outward beyond the in-

fluence of the fibroelastic extensions so that the medial and upward force has little or no influence upon the wound and it is permitted to heal side-to-side. The wound edges should be beveled and the longitudinal ends tapered so that there is a gradual slope to the skin surface in all directions. This type of wound is not likely to become complicated by 'bridging' or undermining of its edges. The problem of wound healing resolves itself into one of making every effort to minimize infection and of promoting local resistance of the tissues.

Sulfathiazidine given by mouth has been found to be effective in diminishing the infection of anorectal wounds.

The postoperative care of an anorectal wound largely determines the rate of its healing. Oxycel gauze as a postoperative dressing will greatly decrease postoperative bleeding and will not interfere with healing of the wound. The gauze is liquefied and absorbed or discharged from the wound in 72 hours. The wound is examined daily spreading apart the buttocks and separating the edges of the wound. This tends to discourage early 'bridging' of the tissues. Furacin is applied to the wound with a small sterile cotton tipped applicator at each examination. On the second postoperative day warm moist applications are applied to the wound and on the following day after an enema brings the first bowel movement, hot sitz baths are given the patient. While in the tub the patient is instructed to hold his buttocks apart so that the water may enter the anal canal. Sitz baths are repeated twice daily. In the interval a soft piece of cotton is placed in the wound to protect its surfaces from physical injury.

After the patient leaves the hospital he is seen twice weekly in the office and at each visit the wound is inspected for bridging, pocketing, or undermining of its edges. The appearance of an excess of granulation tissue usually indicates bridging of the wound sinus formation or undermining of the wound edges. When these complications of healing are discovered they should be corrected immediately. Granulation tissue tabs should be excised and the flat granulating surfaces which project above the skin surface should be treated with a silver nitrate applicator. Undermining of the wound edge is usually present in the longitudinal end of the wound and is treated by raising a small wheal of procaine in the skin over the area and opening up that portion of the wound with a small pair of scissors. The edges of the skin are then trimmed back and bleeding is controlled with an oxycel dressing.

CHARLES BARON M.D.

#### LIVER, GALL BLADDER, PANCREAS, AND SPLEEN

**The Use of the Long T Tube in Surgery of the Biliary Tract.** RICHARD B. CASTELL *Surg Clin. N. America* 1948 28 659.

The author discusses the uses of the long T-tube in surgery of the biliary tract. In contrast with the

Pathological studies indicated that the returning limb was regularly found to be severely damaged, even at the point of gangrene at a time when the bowel in the entering limb was still viable. This was undoubtedly due to the devascularization of the returning limb by the acute kinking of the bowel as it turned on itself at the apex of the intussusception. Hemorrhage and engorgement disappeared first after reduction, then edema, and lastly cellular infiltration. The mucosa is frequently partially sloughed or eroded and pathogenic bacteria made their way through the serosal surface even in bowel which appeared apparently preserved. This may have been a partial explanation of the fever seen clinically after reduction and of the frequency of abscesses and infection after operative reduction.

Intussusception was reduced in 35 and 38 hours of duration in dogs and can be reduced by a hydrostatic pressure of 3 feet. Intussusception in 48 hours of duration in rabbits is reducible by hydrostatic pressure.

HAROLD LATTIN, I.D.

**Mucocoeles of the Appendix with Tumorous Tendencies** (Les mucocèles de l'appendice à déterminations tumorales). M. CH. ROUX AND L. M. ROUX. *J. Ch. Par.* 913, 645.

Mucocoele of the appendix may produce a rare type of palpable tumor in the right side of the abdomen or flank. The authors report such a case in a 55-year-old woman. The history and findings are reviewed.

A right pararectal incision is recommended for exposure of these lesions because it permits exploration of the region and excision of a free mucocoele and because it can be extended proximally to permit hemicolectomy when necessary.

LOW RO W. GIBBS, M.D.

**Surgery of the Lower Bowel.** II. BY E. BAGO AND ROBERT J. RWE. *J. Am. M. A.* 913, 30-975.

The authors report a reduction in the mortality rate for colon resection from 6.4 per cent in 346 cases observed prior to January 1946 to zero in 142 cases observed subsequent to that date. This low figure is attributed to careful preoperative evaluation, preparation and postoperative care. Surgical technique is not discussed.

The patient who requires colon surgery should be hospitalized for several days prior to the operative procedure. During this time he is carefully evaluated as to surgical risk. Every means is utilized to place him in optimal nutritional, fluid, electrolyte, nitrogen, and vitamin balance. His patency and renal function must be corrected. The bowel is prepared with a combination of phthalylsulfathiazole and streptomycin; the latter being limited to the period from 48 to 72 hours immediately before surgery to avoid the development of streptomycin resistance.

Proper postoperative management embraces adequate nutrition and fluid balance. Penicillin is given routinely. Arteriospasm is relieved by a lumbosacral therapy; the best prophylaxis for throm-

boembolism. Other postoperative complications and means to prevent them are described.

EDWARD W. GIBBS, M.D.

**Clinical Aspects of Carcinoma of the Cecum and Ascending Colon: Report of 68 Cases.** CHALLICE H. BROWN, JAMES R. COLVERT, and BROCK E. BRUSH. *Ann. Int. M.*, 1945, 38-940.

The authors analyze 68 case histories of carcinoma of the cecum and ascending colon. The predominant symptoms were pain (76 per cent), obstruction with cramps and colic (38 per cent), vomiting (31 per cent), diarrhea (30 per cent), and anemia with less than 13 gm. of hemoglobin (79 per cent) and with less than 11 gm. (54 per cent).

The most noteworthy findings were that 32 per cent of the patients had an annular type of growth and 25 per cent a constricting or obstructive lesion. The immediate postoperative mortality in the last 5 years was 8 per cent. Seventy-one per cent of the patients with no evidence of metastases are living for an average of 3.8 years after operation, whereas 29 per cent with metastatic lesions are living on an average of 4 years after operation.

STEPHEN A. ZINN, M.D.

**Microcolon.** JONASSEN ZIMMER. *Acta radiol. Stockh.* 913-29-32.

The congenitally small colon or microcolon designates a condition in which the entire large bowel (except the rectum) of a newborn infant is anatomically found to have a diameter of around 4 to 8 mm. The condition has been reported rather infrequently. There are two types of microcolon: the primary and the secondary. In both types microscopy reveals a perfectly built normal bowel, consisting of all layers but with a small lumen. The primary type according to various authors is attributable to developmental factors: primary dilatation and hypertrophy of the small intestine, primary hypoplasia of the colon, temporary incarceration of a segment of the small intestine changes in the innervation, and mechanical factors while the secondary type is due to organic obstruction. The author presents the findings in 2 cases, one of each type.

The following two roentgenologic features are stressed: (1) the absence of fluid levels in the intestinal tract on vertical roentgenograms must be due to the inspissated content in the bowel and is probably pathognomonic of meconium ileus, and (2) the absence of taunt plicae circulaires in the small intestine, which makes it almost impossible to distinguish between the small bowel and the colon.

In cases of organic obstruction two points should be noted: fluid levels are often present and hard, granulated fecal matter is not seen in the roentgenograms.

Barium enema may be of diagnostic value. A barium meal is usually contraindicated. The roentgen examination is usually of value in establishing the diagnosis of microcolon.

FAYE L. HENRY, M.D.

before the development of marked inflammatory changes and before the development of serious complicating factors which so profoundly influence morbidity and mortality.

A careful study of this series of 74 pathologically proved cases of acute cholecystitis and of their clinical manifestations confirms this conclusion of the unpredictability of clinical signs and laboratory findings in estimating the degree of inflammatory change.

Furthermore the inability to follow the pathologic process accurately by clinical means is illustrated by the fact that perforation occurs in from 6.82 per cent (Bachhuber) to 13 per cent (Clagett) and to 20 per cent in the large collected series reported by Heuer. The average reported mortality in cases of perforation is about 45 per cent. This does not include either or subsequent sequelae of a perforated viscus. There were 9 perforations among the 74 cases reported.

The highest mortality still remains in the older age group who have concomitant organic disease. In Bachhuber's series, 69.23 per cent of the patients were over 63 years of age and almost all had had repeated attacks as well as concurrent disease. M. K. Smith stated that the fatalities are confined to the older age group and that peritonitis is not so frequently a cause as suspected. Elason and Stevens found the mortality after 60 years to be eight to ten times greater than that before the age of 60, they also discount the factor of infection as a contraindication to early operation. Bachhuber best summarized the situation when he wrote: "For the more recurrent attacks the patient has the older the age, the more likely it is that the patient may also be suffering from some serious concomitant disease all of which contributes to the mortality."

Stones in the common duct are more often an accompanying feature of acute cholecystitis than is generally thought. Thirty five of the 74 patients whose cases are reported had common duct explorations. Stones were found in 12 cases, an incidence of 16.2 per cent which very closely parallels the occurrence of common duct stones in the chronic calculous gall bladder. Common duct stones should be searched for just as carefully in acute disease of the gall bladder as in the chronic uninfamed gall bladder and will just as frequently be found.

Cholecystectomy was accomplished in 73 cases. In 51 cases however the operating surgeons elected to do the dissection from the fundus to the cystic duct instead of carrying out a retrograde dissection as is the usual method in this clinic. The marked edema makes this method of dissection easier and safer in most cases since it permits easier visualization of the cystic artery, cystic duct and also the common duct which may be obscured by the marked edema which often involves the tissues over the common duct to a marked degree. Of the 11 patients operated on within 48 hours of the onset of symptoms 5 had dissections from the fundus to the cystic duct and 6 in the retrograde manner. Perhaps the sulfonamides and antibiotic agents will in many instances affect the time of surgical intervention but undoubt-

edly if the acute gall bladder were considered and treated as any other acute abdominal emergency morbidity and operative risk could be kept at a minimum. These therapeutic agents are by no means a substitute for urgent surgery.

The authors have reported a consecutive series of 74 pathologically proved cases of acute disease of the gall bladder with 1 postoperative death, a mortality of 1.3 per cent.

Acute cholecystitis is an acute surgical condition in which early operation preferably within 48 hours after the onset of symptoms permits a more thorough operation at less expenditure of time, money and suffering on the part of the patient as well as reduction in the operative risk. Because of the relatively high incidence of common duct stones they should be carefully sought for and removed in acute disease of the gall bladder as in other cases of disease of the gall bladder. Cholecystostomy has a limited indication in the treatment of acute cholecystitis but is a valuable surgical procedure in some cases. Early operation should reduce the mortality in the older age group as it lessens the hazards of depleted reserves in cases of concomitant disease. In an editorial entitled *Acute Cholecystitis—Why Delay?* C. G. Heyd wrote: "The indication is to operate carefully with due celerity, relieve the mechanical obstruction and provide drainage. Teachers of surgery who lend their prestige and give support to a policy of waiting provide authority for timid surgeons in experienced operators and procrastinating practitioners."

BENJAMIN GOLDMAN, M.D.

#### The Surgical Treatment of Acute Cholecystitis. FRANK GLENN, *Surgery* 1948 35:397

The philosophy of surgical removal of the gall bladder early in the acute phase of cholecystitis is based on the premise that removal of the gall bladder interrupts the pathologic process and averts the danger of gangrene and perforation. The procedure is contraindicated in the presence of peritonitis due to perforation of the gall bladder, when there are technical difficulties which make it impossible to identify important structures. In the presence of severe obstructive jaundice, and in patients whose general condition is so grave that they will not tolerate such an extensive procedure.

The patients over 50 years of age offer a much greater risk both because of more advanced disease of the biliary system and because of the frequency of a serious concomitant disease.

There were 586 patients in the series treated by early surgery. The over-all mortality was 17 deaths or 2.8 per cent. There were 381 patients under 50 years of age with a mortality of 1.04 per cent while in the group over 50 years, comprising 205 cases the mortality was 6.1 per cent. The mortality following cholecystostomy and common duct exploration was relatively higher which indicated that there was a much greater initial risk in the latter group.

The author believes that early operation for acute cholecystitis, both in relation to the individual at

commonest T tube which has a 4.5 inch transverse limb. The long T tube has a 12 inch horizontal limb which the approximate length of the vertical portion. It may be either of the usual red rubber or of pure gum or of synthetic rubber. Because of a problem in using it is easier to join the equal length of tubing to the midportion of one so that each end is 6 inches long.

I reviewed the papers of 15 patients with obstruction of the biliary duct persisting after previous operation. The a thorbelies that such unsatisfactory results may be avoided by employing the long T tube with the distal limb passing through the papilla into the duodenum. This tube is perfectly adapted for:

(1) relieving the common distal stenosis (2) fibrosis of the ampulla (3) repair of benign strictures (4) malformation of the bile duct (5) certain gastroduodenal resection in duodenal ulcers and (6) duodenal diverticula.

The author discusses the theoretic objections to placing the tube through the ampulla particularly the possibility of reflux of the duodenal contents into the biliary duct system. In his large experience he has never observed the occurrence of this complication. These patients have so rarely developed attack of cholangitis as to be known by the occurrence of transient jaundice, malaise, chill, and fever even though the tube is left in place for a year or more that use of the long T tube is not contraindicated. The author fully, however, emphasizes that these tubes require irrigations throughout the time they remain in place. During the immediate postoperative period anal irrigation can be utilized and thus the amount of intracanalicular therapy may be decreased.

ROBERT T. REILLY, M.D.

#### Congenital Cystic Disease of the Liver LAWRENCE CURRIE, *Ill. J. Surg.* 91: 56, 93

Nonparasitic hepatic cysts occur singly in small or large groups or in extreme profusion. The author reports 3 cases illustrating various features of congenital cystic disease. Clinical differentiation between solitary cyst and polycystic disease remains impossible. In these two conditions the treatment as well as the prognosis differs. In the adult form the cysts are often pedunculated and favorable for resection, while polycystic disease is difficult to resect large or distant multiple parenchymatous together with the structures of the liver associated with cystic degeneration of the kidney or sometimes other organs. In operationally favorable circumstances the removal of polycystic malformation has been accomplished successfully but has rare special difficulties and inherent in the disease does alter the general surgical procedure for the attack of cystic disease of the liver.

In the treatment of polycystic disease, removal of the diseased or infected portions offers the only real therapeutic cure. The radical procedure may be the only method of cystic disease, but in the

kidneys or another organ. Ordinarily the anatomic situation can be defined only by exploration, at which time a choice must be made between excising the involved portion of the liver or doing nothing. Excision of the lesion is contraindicated in the presence of ascites or in cystic disease of the liver without symptoms.

The earliest symptoms often proceed from the associated polycystic disease of the kidneys. Polycystic disease of the liver may not interfere with good health since symptoms are usually due to pressure. Liver function tests are ordinarily normal. The right lobe of the liver is involved about 5 times more often than the left and women are more frequently affected than men. Approximately one half of the reported cases of congenital cystic disease of the liver have been polycystic and the average age of the patients has been 33 years. No pathognomonic features are produced by the cystic liver.

JOHN L. LINDQUIST, M.D.

#### The Acute Gall Bladder SAMUEL F. MARSHALL and E. S. PHILLIPS, *Surg. Clin. N. America*, 1913 28, 633

Acute conditions of the gall bladder should very properly be classified as emergencies, and surgical treatment should be undertaken as early as the general condition of the patient will permit.

The authors report a series of 74 patients with acute disease of the gall bladder who submitted to operation. The diagnosis had been established by careful pathologic examination of the removed specimens.

In 1923 Walton of England proposed operation early after the onset of the disease process and there by precipitated a more or less controversial discussion of surgical management. It relates to the optimal time for surgical intervention. In 1930, in this country many surgeons questioned the advisability of this method of surgical treatment and by 1933 many articles appeared in the literature with propositions for both the immediate and delayed methods of surgical treatment.

Statistics are cited to support both viewpoints however very often the definitions "early" and "immediate" operations had diverse meanings in the different series and consequently permitted no comparison of surgical result. The authors believe that more logical approach to the problem would be to define early operation so to include those patients operated on within 72 hours of the onset of acute symptoms "immediate" after from 2 hours to the complete cessation of clinical manifestations and "late" as a time after the clinical remission of objective and subjective symptoms. They would prefer to regard all cases of this nature as emergencies to admit all patients at once to the hospital and to operate soon the diagnosis can be established, the patient's general condition can be evaluated, and the chemical and fluid balance can be restored. These operations should very properly be listed as "early" surgical procedures. This should be the ideal method of treatment wherein operation could be carried out

the development of marked inflammatory process and before the development of serious complicating factors which so profoundly influence mortality and mortality.

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Furthermore the inability to follow the pathologic process accurately by clinical means is illustrated by the fact that perforation occurs in from 6.82 per cent (Bachhuber) to 13 per cent (Clagett) and to 20 per cent in the large collected series reported by Heuer. The average reported mortality in cases of perforation is about 45 per cent. This does not include other or subsequent sequelae of a perforated viscus. There were 9 perforations among the 74 cases reported.

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The author believes that early operation for acute cholecystitis, both in relation to the individual at

tack and the whole course of the disease would favor the number of more complicated cases and the mortality for cholecystitis. This is illustrated by the young pregnant woman who has her first attack of the disease during her pregnancy but goes many years without recurrent attacks and even later risk before cholecystectomy is performed.

FREDERICK C. HOK, M.D.

**Gall Bladder G. C. Engren, POSWELL K. BROW, and LEO M. LAW, *Gynecology* 1945, 10: 6.**

The case histories of 39 patients who died following biliary tract surgery at the Buffalo General Hospital showed that 6 apparently had Clostridium infection. Three of them died as a result of it. Clostridium welchii infection and gangrene of the feces may be considered major contributors to the fatality. Two case histories are reported in detail: one fatal case and a case in which the patient did not die.

Diabetes mellitus was present in a mild degree in 7 cases. One surgical was the only one recorded in the literature.

The patient who died was considered to be in a satisfactory condition for 12 hours, but then hematemeses and all the symptoms of acute infection developed. He died 36 hours after operation. An autopsy was performed which showed that the greatest involvement was in the liver adjacent to the site of removal of the gall bladder. The patient who survived was a 60-year-old man. Roentgenogram showed a gall shadow in the gall bladder region which proved not to be in the colon. It is suggested that if this condition is encountered unexpectedly at operation, open packing of the wound would be advisable. The use of penicillin for all biliary tract surgery before and after operation might help to limit this infection.

ROSE J. BRYANT, M.D.

**Cholecholestomy Its Place in Surgery of the Biliary Tract, RICHARD P. COLCOCK, *Surg. Clin. N. Amer.* 1945, 3: 64.**

The author emphasizes his belief that the mortality in biliary tract surgery is closely related to the selection of common duct disease and the delayed treatment of gall tumors.

There is a group of symptoms and physical signs that fire the rat of operation which is usually advised in the presence of a common duct stone in a patient with disease of the biliary tract. This means that the advisability of exploring the common duct for common duct stones must be carefully considered in a patient operated on for cholelithiasis.

If the biliary physical examination and operation are carefully reviewed and evaluated with the knowledge that common duct stones will be left behind, the overall mortality of surgical procedures with biliary tract disease will decrease. Just this is the group of symptoms which will point to the common duct so that relief is possible and that stone is definitely present in the

common duct. Certain symptoms such as jaundice recur frequently the result of stones in the common duct so that when jaundice is present one instantly thinks of this possibility yet if the surgeon carries out surgical procedures on the biliary tract limits his indications for exploring the common duct to the presence of jaundice he will leave behind almost as many common duct stones as he removes.

There are a number of signs and symptoms which are present in patients being operated upon for cholelithiasis should suggest to the operating surgeon the advisability of exploring the common duct.

The most important indications for exploration of the common duct are those of jaundice, cholecystitis, subclinical or dilated or thickened common duct, small stones in the gall bladder, the positive finding of stones or stones in the common duct, the finding of dark bile and sediment on aspiration of the duct, and the presence of either acute or subacute pancreatitis.

The author points out the necessity for adequate exposure and careful exploration. He warns against the use of force in passing dilators into the duodenum and suggests the irrigation of the duct with saline per catheter. He is opposed to the use of immediate cholangiography. He prefers the use of a well secured T tube in the duct which is clamped off for 24 hours on the seventh postoperative day. This clamping is increased until the stools become well colored. A cholangiogram is made before the T tube is removed.

The advisability of exploring the common bile duct should be considered in every patient who has a cholecystectomy. It should be carried out if any one of a number of indications is present. Stones in the common bile duct will be overlooked, and the morbidity and mortality following surgical procedures on the biliary tract will be increased if jaundice is used as the sole criterion for exploring the common bile duct.

BERNARD GOLDMAN, M.D.

**Cholecholestomy, ROBERT W. NIXTON and LLOYD R. BEEK, *Jr. Surgery* 1945, 3: 760.**

This study was made in the period from 1934 to 1936. There were 70 complications occurring in 439 patients with a morbidity of 15.9 per cent. In 75 per cent the complications appeared to be definitely related to cholecholestomy alone. The mortality rates from cholecholestomy have improved from 16 per cent in 1934 to 2 per cent in 1936. The authors suggest that certain criteria should be met before the common duct is opened. They are:

1. Palpable stone in the hepatic or common bile ducts.
2. Recent jaundice.
3. Dilatation of the duct or thickening of the bile duct.
4. Clinical evidence of cholangitis.
5. Multiple small stones in the gall bladder.
6. Thickening or induration of the head of the pancreas.
7. Biliary colic without stones in the gall bladder.

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Table I shows the complications following cholecystectomy in 40 cases. Table II shows the incidence of cholecystectomy in 61 cases with nonpalpable calculi.

of Structures of the common duct 33 337

[illegible]

In 3 cases of the original 13 a satisfactory result was obtained with end-to-end suture after operation for 335 5 and 8 years respectively with these cases the surgeon on his experience with these cases the

Several points in technique and management are emphasized. First the obvious necessity of returning these patients to physiologic and nutritional balance before surgery is attempted is stressed. Vitamin therapy doses is a necessity.

K. In large doses is a necessity. Locating the proximal end of the common duct is enhanced by sharp dissection close to the under surface of the right lobe of the liver and approaching the hilum from the anterior and to the right. The bulbous end of the common duct appears as a bluish tinged cystlike structure shining through the scar tissue. The distal end can almost always be found by mobilizing the duodenum and reflecting it to the left to pick up the retroduodenal position of the duct. Vitalium tubes are difficult to keep in place for long periods of time and tend to plug with biliary concretions and therefore they are probably inferior to either a fenestrated catheter or a T tube which can be securely held in place and removed when desirable. Anastomosis is more desirable than is a serous anastomosis.

**Surgical Treatment of Carcinoma of the Ampulla of Vater and the Extrahepatic Bile Ducts.** A 14  
JOS. E. SILVER and MAX M. ZIMMERMAN Arch Surg  
1918 57 199

**Surgical Treatment of Carcinoma of the Ampulla of Vater and the Extrahepatic Bile Ducts.** A 14  
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The experience with these cancers during the 10 year period from 1937 to 1946 during which time 11,915 patients were admitted to the surgical service



of the Cincinnati General Hospital, is reported. Both cancers are rare.

Carcinoma of the ampulla of Vater constitutes about 1.15 per cent of all cancers in autopsy statistics. Eight cases were observed at the Cincinnati General Hospital during the 10-year period: a clinical incidence of 0.27 per cent. The average age was 57.3 years. Six occurred in males, a sex incidence of 3 males to 1 female. The average life expectancy in untreated cases after the onset of symptoms is from 3 to 8 months, with death resulting from liver damage.

The important findings which lead to a working clinical diagnosis of carcinoma are: (1) persistent epigastric discomfort or pain, (2) anorexia and weight loss, (3) obstructive jaundice, (4) anemia of secondary type, (5) persistent occult blood in stool, (6) blood in duodenal secretion, and (7) roentgenologic evidence of a filling defect or "reversed 3 sign" in the peripapillary region.

Pain, although a characteristic symptom, is of no definite type. The persistence of occult blood in the stool is regarded of major importance. The differential diagnosis can be established only by exploration.

The treatment of choice is partial duodenopancreatectomy. Whether operation is a one-stage or two-stage procedure must be left to the judgment of the surgeon in the individual case. Among the 8 cases the resectability was 50 per cent. One patient is living after 3 years and 10 months; another lived 7 years and then died of metastatic melanoma of the skin.

Ten cases of carcinoma of the extrahepatic bile ducts were seen in the 10-year period, a clinical incidence of 3.6 per cent. Autopsy statistics indicate the incidence of these lesions to be about 0.13 per cent of all carcinomas. The average age of the patients seen was 61.5 years, with a sex ratio of 3 males to 2 females.

The differential diagnosis is the same as for ampullary lesions. Pain radiating through the back is helpful in early diagnosis. Partial choledochoduodenopancreatectomy is the most desirable operative procedure when possible.

Eight of the 10 patients were explored. Six were inoperable. In 1 patient palliative operation (first-stage Whipple) was possible, and in another radical resection was done. The latter lived 1 year and 5 months; none of the others lived longer than 3 months after exploration.

Ampullary carcinoma has a higher resectability rate than does carcinoma arising from the extrahepatic bile ducts.

FRANK B. QUEEN, M.D.

**Phlebotromboses Associated with Mucin Producing Carcinomas of the Tail and Body of the Pancreas: A Clinicopathologic Study of 2 Cases with Necropsy** W. K. JENKINSON and WILLIAM O. RUSSELL. *Arch. Surg.* 94:5 361-86.

Contrary to cancers in other sites, pain is one of the earliest and most reliable symptoms of cancer of the body and tail of the pancreas, and upper abdominal

pain constitutes the most frequent complaint in this condition. Three types of pain have been described as typical of this disease: (1) dull, aching pain often referred to the back, (2) paroxysmal pain at the umbilical level, often referred to the back, and (3) right upper quadrant pain resembling that in biliary colic.

Venous thromboses are also reported as being frequently associated with cancer of the body and tail of the pancreas (up to 56 per cent in autopsy series). In several instances the symptoms of peripheral venous thrombosis constitute the patient's initial complaint. It may be that unaccountable phlebotromboses will prove an early clue to the existence of pancreatic carcinoma.

Two cases of mucinous carcinoma of the tail and body of the pancreas with multiple venous thromboses involving both the portal and systemic systems are reported in support of the observations reported. In one, pain was the first symptom. In the other it was unexplained phlebotrombosis of the leg. Since no adequate explanation for the multiple thromboses was revealed by autopsy in either case, some yet unidentified property of mucinous carcinoma of the pancreas is postulated as possibly being associated with thrombosis in these patients.

FRANK B. QUEEN, M.D.

**A Technique for Pancreaticoduodenal Resection.** RICHARD B. CAYDELL. *Surg. Clin. N. America*, 1948, 23: 76.

The author considers four findings a contraindication to pancreaticoduodenal resection: (1) distant metastases, (2) local spread with direct invasion beyond a possible limit of resection, (3) involvement of the superior mesenteric vessels, and (4) involvement of the portal vein. The involvement of the superior mesenteric vessels can be determined by division of the gastroduodenal artery and incision of the peritoneum on the inferior border of the pancreas. Similarly the portal vein can be identified by division of the gastroduodenal artery and displacement of the common duct downward, which permits digital examination of the posterior surface of the head of the pancreas by displacing the portal vein backward.

The author prefers a two-stage procedure. At the first stage an anticolic cholecystojejunostomy is done. If the lesion cannot be resected an enterocenterostomy is also performed. Also in nonresectable cases a side-to-side anastomosis is made between the pancreatic duct and the jejunal loop over a T tube when possible.

The second stage of the procedure is carried out by reopening the first incision and lengthening it. The previous anastomosis is freed up and displaced to the right and downward. The peritoneum over the kidney is incised to the right of the duodenum, and the duodenum and head of the pancreas are elevated and rotated to the left. This will expose on the posterior aspect of the abdomen, in turn, the spermatic or ovarian vein, the inferior vena cava, and the aorta.

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The lesser omental sac is entered through the anterior two layers of the gastrocolic omentum at the extreme right margin. The posterior portion of the gastrocolic omentum is then displaced downward which permits identification of the middle colic vessels. The peritoneum is incised to the right, the hepatic flexure and right half of the transverse colon are freed and displaced downward. The peritoneum is then incised at the inferior border of the pancreatic body to expose the superior mesenteric artery. The superior mesenteric artery is next identified and the inferior pancreaticoduodenal artery is ligated and divided.

The lower half of the gastrohepatic omentum is incised, the right gastric artery ligated and divided and the course of the hepatic artery determined. The gastroduodenal artery is identified where it leaves the hepatic artery. It will be found to have a very short trunk before it divides usually into four branches. This allows about 1 centimeter of the artery to be dissected free and divided between ligatures.

The common duct is then freed up and the site of entry of the cystic duct exposed. The common duct is displaced downward and the anterior surface of the portal vein visualized. A finger can be passed under the head of the pancreas on top of the portal vein, which has no branches and the finger is passed through so as to emerge below the body of the pancreas and anterior to the superior mesenteric vein. Careful palpation of the entire region can at this time determine the operability of the lesion before division of either the stomach or common bile duct.

The common duct can now be divided between clamps at the proper point. This will vary greatly according to the site of the malignancy. If the first stage operation has been done and the cystic duct found too close to the desired point of resection the common duct is severed and left for implantation in the jejunum beside the cholecystojejunostomy. In rare instances it will be found necessary to remove the gall bladder and disconnect the cholecystojejunostomy. In the two-stage procedure when the common duct is not near the point of division the common duct is carefully turned in by inversion sutures with silk for the outer layer.

The pyloric end of the stomach is then freed of its vessels and clamps are placed across it usually from  $1\frac{1}{2}$  to 2 inches (3.7 to 5 cm) proximal to the pylorus. The proximal clamp on the stomach can be placed within the abdominal cavity on the left side of the abdomen which leaves the entire anterior surface of the body of the pancreas exposed.

The body of the pancreas is now lifted up on the finger and a point selected for transection. The main arterial blood supply of the pancreatic body runs along the superior and inferior aspects as longitudinal pancreatic arteries. Suture ligatures are placed on both superior and inferior aspects of the pancreas with nonabsorbable suture material to enclose about 1 centimeter of the pancreas. These are used in the distal portion of the pancreas near the line of resec-

tion. The pancreas is then transected bleeding from the proximal side being controlled with Allis clamps. The duct of Wirsung is dissected out before division is completed and left to project from the cut surface of the pancreas. This division exposes the portal vein and the junction of its tributaries the superior mesenteric and splenic veins. The pancreas is then closed with interrupted mattress sutures of silk the duct of Wirsung being left open. If the duct is dilated a catheter of appropriate size is placed in it if the duct is small it is ligated with fine plain catgut and then transfixed behind the tie by passing a braided silk suture halfway through it. The portion of the pancreas remaining is displaced to the left. The transverse colon is raised and a point selected for division of the jejunum about 7.5 cm distal to the ligament of Treitz. The ligament of Treitz is completely severed and the proximal jejunum and fourth portion of the duodenum are freed. The mesentery of the proximal jejunum is then divided and the vessels are ligated. The jejunum is divided between clamps and the proximal end is closed, the sutures being left long for traction.

The division of the ligament of Treitz which frees the proximal jejunum beneath the superior mesenteric vessels makes a free communication between this area and the dissection previously carried out on the right side of the abdomen. The proximal jejunum and the fourth portion of the duodenum are drawn through beneath the superior mesenteric vessels to the right. By elevation of the duodenum and head of the pancreas, the uncinate process can be freed up posteriorly. This is the most difficult part of the operative procedure.

After elevation of the pyloric end of the stomach head of the pancreas, and duodenum the short branches of the superior mesenteric vein and superior mesenteric artery which go to the head of the pancreas the uncinate process and the fourth and third portions of the duodenum are then divided between clamps, which permits delivery of the specimen. Sheets of gelfoam or oxidized cellulose (oxycel) may be useful in the control of capillary ooze.

A point is then selected on the afferent loop of jejunum for the anastomosis of the pancreatic duct. If the duct is small, a pressure necrosing suture technique is used. Usually the duct of Wirsung will be large enough to permit careful suture over a rubber tube. The amesenteric surface of the jejunum at the point selected is incised for the same distance as the width of the cut closed end of the pancreas. The jejunum is sutured to the pancreas with interrupted silk sutures passing through the area previously closed by the mattress sutures of the pancreas to prevent the sutures from pulling out. When the posterior suture line has been completed two interrupted sutures of the jejunum are opened and the mucosa of the duct of catgut are taken between the mucosa of the duct and the mucosa of the jejunum. A rubber tube is then inserted and anchored with a silk suture. Two interrupted sutures are taken in the mucosa anteriorly and the anastomosis is completed by interrupted

silk sutures through the anterior wall of the jejunum and pancreas.

In the two-stage procedure, the biliary tract anastomosis will have been completed by the first stage cholecystojejunostomy. In some cases it will be necessary to implant the common bile duct into the jejunum as an end-to-side procedure just proximal to the gall bladder. This is the same anastomosis as carried out in the one stage procedure and is done in two layers over a rubber tube.

If the enterocenterostomy was not done proximal to these anastomoses in the first-stage procedure it is done as the third anastomosis. The final procedure is an end-to-end anastomosis of the stomach to the jejunum.

A cigaret drain is placed down to the resected uncinate process and brought out between the biliary and pancreatic anastomoses through the upper portion of the wound. EARL O. LATIMER, M.D.

**Total Pancreatectomy** JOHN M. WAUGH, J. (in M. J. 4, 943-37-4)

Radical resection of the head of the pancreas and of the duodenum had been done 49 times at the May Clinic up to January 1, 1947. Eleven operations were for benign disease and 38 for malignant lesions. Six patients underwent total pancreatectomy with 1 death in the hospital.

The indications for resection of the head of the pancreas and total pancreatectomy for benign disease are discussed and it is emphasized that in such instances resection should be carried out only after careful evaluation of both the operative risk entailed and the disturbances in metabolism which might be expected.

Resection for carcinoma was accompanied by an operative mortality rate of 21 per cent. In the future this figure should become lower for already one-stage resection for carcinoma of the head of the pancreas has been performed 15 times with a hospital mortality rate of only 13 per cent.

A follow-up study of the 30 patients who had undergone resection for malignant processes prior to January 1, 1946 and had survived operation showed that 3 of 14 who had had carcinoma of the head of the pancreas and 5 of 8 who had had carcinoma of the ampulla of Vater were still alive on that date. The authors state that, other than surgical treatment there is no therapeutic measure available which gives these patients any chance for cure; hence, attempts should be constantly made to lower the operative mortality rate for the procedure and to improve diagnostic acumen so that resection can be carried out more often while the carcinoma is still in a curable stage.

**Principal Indications for Splenectomy During Childhood.** GEORGE VAN BUREN and GEORGE M. CURTIS. *Arch. Surg.* 1943 56-5.

The principal indications for splenectomy in childhood are thrombocytopenic purpura, congenital hemolytic icterus, and Rant's syndrome.

The presenting symptoms of 22 children with thrombocytopenic purpura were subcutaneous ecchymotic or petechial hemorrhages (91 per cent) bleeding from the mucous membrane (73 per cent) a history of bruising easily (32 per cent) and weakness (9 per cent). The results following splenectomy in this group of children have been outstanding.

Congenital hemolytic icterus is a chronic blood dyscrasia characterized by a microcytic anemia, increased red cell fragility, reticulocytosis, acholic jaundice, and splenomegaly. Occasionally "crises" occur. The presenting symptoms of 20 children with this disease were jaundice (70 per cent) weakness (40 per cent) pallor (35 per cent) splenomegaly (30 per cent) nausea and vomiting (10 per cent) chills and fever (0 per cent) and abdominal pain (5 per cent). In the critical state emergency splenectomy is the procedure of choice.

Splenectomy for Rant's syndrome is most successful if carried out in the early stages of the disease. EDWARD W. GIBBS, M.D.

**Spread of Carcinoma to the Spleen: Its Relation to Generalized Carcinomatous Spread** JOHN W. HARMAN and L. C. D. DICO. *Arch. Path. Chic.* 943 43-9.

The authors studied the spread of carcinoma to the spleen and its relation to generalized carcinomatous spread. They studied only those cases of carcinoma in which there were secondary growths in one or more viscera within the thoracic and abdominal cavities regardless of the primary source. This eliminated the cases of carcinoma without metastases and those with regional spread only, as well as cases of direct extension. Thus only 30 of 116 cases of carcinoma collected from a total of 663 autopsies performed in the years from 1945 to 1954 at the University of Wisconsin Medical School Hospital Madison met the projected requirements.

In addition to routine autopsy examination, attention was paid to the spleen which was studied extensively grossly and microscopically. The criterion of Warren and Dicks laid down in 1934, which regarded all noncontiguous masses of tumor cells as metastases, was adhered to by Harman and Dicks. The pancreas was also examined specifically for secondary new growths because its arterial supply is associated with that of the spleen and because the pancreas is regarded as a rare site of metastases. Both organs derive their principal arterial supply from the same branch of the celiac axis, which would permit an equal chance of receiving hematogenous tumor emboli—a circumstance that might reveal any particular resistance of the spleen if there were a discrepancy in incidence. A special analysis of carcinomas of the stomach and the pancreas showed no peculiar propensity of these neoplasms to invade the spleen through the venous drainage system.

The authors found that in 30 cases of carcinoma in which metastases occurred in one or more organs in more than one body cavity the incidence of splenic and pancreatic metastases was 50 and 43

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per cent, respectively. In no instance were splenic metastases found apart from generalized spread in the gastric and pancreatic cases. The low occurrence of splenic metastases as compared with metastases in lymph nodes liver and lungs was due to inequality of exposure to metastases. When the exposure was equalized the spleen was not less susceptible than other viscera.

ROBERT TURELL, M.D.

## MISCELLANEOUS

**Ligation of the Splenic Artery in Patients with Portal Hypertension** TILDEN C. EVERTSON and WARREN H. COLZ. *Arch. Surg.* 1948 56 153

The operation of portacaval shunt for the relief of portal hypertension is a successful procedure for the good risk patient. However many patients are poor operative risks for such a formidable procedure. For the latter group the authors recommend ligation of the splenic artery.

Following ligation of the splenic artery in patients with portal hypertension there is an appreciable decrease in the size of the spleen but no evidence of necrosis. The veins transporting blood from the spleen are not disturbed and serve as channels for the escape of portal blood. The technique is simple. Three successful cases are reported in detail.

EDWARD W. GIBBS, M.D.

**Absorption of Blood from the Peritoneal Cavity** CLAUDE R. SKEAD. *Arch. Surg.* 1948 56 249.

Investigation shows that surgeons differ concerning the advisability of removal of fluid blood and clots from the peritoneal cavity after intraperitoneal hemorrhage or operative procedures. The purpose of the experiments was to determine the fate of blood introduced into the peritoneal cavity, its possible usefulness as a substitute for transfusion on occasions when the usual methods are inapplicable or too difficult, and its effect on the blood volume, hematocrit, reading, hemoglobin and total protein levels. Addi-

tional observations were made to determine if the clinical leucocytosis so frequently observed after intraperitoneal hemorrhage is due to the hemorrhage alone or to the mere presence of blood within the peritoneal cavity. The response of the peritoneum itself to repeated intraperitoneal injections of autogenous blood was also determined.

A review of the literature concerning peritoneal absorption prior to 1923 was written by Cunningham. The method of administering blood by the intraperitoneal route as a means of transfusion or as a preventive measure against peritonitis or adhesions has been studied by many investigators. Some authors concluded that the presence of blood in the peritoneal cavity had no effect on the development of peritonitis while others reported that blood in the peritoneal cavity after abdominal operations offered protection against peritonitis and adhesions.

An increase in hemoglobin and in the erythrocyte count has been reported previously after the injection of blood into the peritoneal cavity but the response of the blood volume to hemoperitoneum has not been investigated.

Blood injected intraperitoneally is more rapidly absorbed if it is kept liquid by the use of an anticoagulant. Citrated blood is completely absorbed within 24 hours after injection. When uncitrated blood is injected clots from 0.5 to 8 cm. in size are observed at 4 days but are absorbed within 9 days after injection. Absorption of blood by way of the peritoneum will raise the blood volume to a maximum in 24 hours when 36 c.c. per kilogram of body weight are injected in dogs. The leucocytosis following hemorrhage into the peritoneal cavity is in some way due to the presence of blood in the peritoneal cavity itself and is not accounted for on the basis of leucocytosis caused by hemorrhage. Moderate peritoneal thickening, omental fibrosis and mesothelial proliferation without adhesions follow repeated intraperitoneal injections of citrated autogenous blood.

HARRY W. FINE, M.D.

# GYNECOLOGY

## UTERUS

**Studies of the Uterine Mucosa.** BIRNELL FALCONER. *Acta obs. gynaecol.*, 1948, 27: 139.

The author advocates that the various cyclic endometrial phases of the uterine mucosa be grouped as follows: (a) desquamation, (b) postmenstrual, (c) early proliferative, (d) late proliferative, (e) transition from the proliferative to the secretory phase, (f) secretion-preparedness, (g) midsecretion, (h) late secretory and (i) premenstrual.

The menstrual or desquamation phase is characterized by (a) endometrial breakdown, hemorrhage and cell infiltration, (b) signs of secretory activity on the part of the epithelial glands, and (c) swollen cells of the stroma showing regressive changes. The diagnosis may not always be easy and the hemorrhages must be differentiated from those from other causes.

The postmenstrual phase overlaps the first week of hemorrhage, thus partly also overlapping desquamation. This is one of the stages in which the histological pictures present the greatest difficulty for diagnosis. This is true also in the transition stages between the proliferative and secretory phases, and at the stage of desquamation.

The early proliferative phase continues approximately to the tenth day of the cycle. Its transition from the postmenstrual phase is ill defined.

The late proliferative phase is characterized by a thick uterine mucosa containing corkscrew-shaped glands, the lumina of which are narrow and lined with an epithelium in which mitoses are scant and the edematous stroma is made up of stellate cells and coiled arterioles. It lasts to the fourteenth or sixteenth day of the cycle.

Transition from the proliferative to the secretory phase does not seem to last longer than 3 days. It probably occurs during the fourteenth to sixteenth days of the cycle. At this time ovulation takes place and the effect of luteinization becomes manifest. This is the time that Mittelschmerz, or intermenstrual pain, may occur with hemorrhage into the endometrium.

The early secretory phase or secretion preparedness is characterized by enlargement and tortuosity of the corkscrew-shaped glands, vacuolation of the epithelium predominantly in the basal zone, edematous stroma, and coiled arterioles. This phase continues to the eighteenth or nineteenth day of the cycle and is followed by the beginning of genuine differentiation.

Midsecretion is a term introduced by American workers. It occurs approximately during the eighteenth to twenty-fourth days of the cycle. Genuine functional development of both glands and the stroma begins. Tortuosity of the glands becomes more marked, and there is definite evidence of secretory glands. The stroma begins to develop

In the late secretory phase the specific changes of the glands and stroma become more marked. The glands assume a saw tooth appearance. The stromal cells continue to accumulate nutrient substance and the arterioles become markedly coiled.

The premenstrual phase seems to begin only during the last 24 hours of the cycle. It is the transition stage to desquamation, a piecemeal affair which is characterized by crumbling and rapid necrosis of the endometrium and hemorrhage.

In analyzing curettage material the pathologist should concentrate his efforts on establishing the endometrial phase as exactly as possible, not being content merely with diagnosis of the proliferative or secretory phase. On the other hand a diagnosis of, for instance, endometrium in the twenty-third day of the cycle is not reasonable in practice. This diagnosis is based on the assumption that the menstrual periods occur regularly every 28 days, which is rarely the case.

T. FLORIN BALL, M.D.

**Hystero-graphy as a Diagnostic Aid in Submucous Myoma.** SYDOR ERIKSSON AND HENRY JONSSON. *Acta obs. gynaecol.*, 1948, 27: 367.

A brief history of hystero-graphy is given. It reveals the difficulty in the making of satisfactory hystero-graphs until the introduction of contrast media soluble in water which event increased the diagnostic value of hystero-graphy.

In describing the method, the authors emphasize the importance of avoiding contrast media which are too opaque otherwise minute structures may be concealed. The examination should be made under the fluoroscope. Several cases are reported and illustrated by figures.

The roentgenographic appearance of submucous myomas varies widely. However, they have one feature in common, i.e., a filling defect, which is regular in outline. Its shape varies with its size, the degree to which it projects into the uterine cavity and the extent to which it is attached to the uterine wall.

In the differential diagnosis, polyps of the endometrium are most important. The latter present an irregular shape and an uneven surface, they accommodate their growth to the shape of the uterine cavity and offer little difficulty in diagnosis. Firm polyps may be difficult or almost impossible to differentiate from myomas, particularly if the latter are pedunculated.

Hystero-graphy should be done in the first half of the menstrual cycle. However, if the contrast medium flows too rapidly through the uterus and takes into the abdominal cavity to permit the making of satisfactory roentgenograms, another x-ray study should be made at a later stage in the cycle.

In cancer of the uterus the hystero-graph reveals a uterine cavity with frayed and irregular contours and a defect in its filling.

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The authors believe this method is a valuable diagnostic aid in submucous myoma and that it should be included in the routine examinations.

T. FLOYD BELL, M.D.

## ADNEXAL AND PERIUTERINE CONDITIONS

**A Contribution to the Study of Suppurating Dermoid Cysts of the Ovary with an External Fistula** (Contributo allo studio delle cisti dermoidi ovariche suppurate e fistolizzate alla parete) GIOVANNI D'ERRICO *Gior Ital chir* 1948 4 99

Although cases of suppurating dermoid cysts of the ovary with an external fistula are exceptional, D'Errico has observed 2 at practically the same time. The first patient, a woman of 59, had had an acute abdominal syndrome 20 years previously characterized by pain in the left flank and moderate fever; she was operated upon after 8 days and a quantity of pus mixed with hairs was evacuated. It is most probable that the symptoms were due to an acute inflammation of the cyst rather than to a torsion of its pedicle. Fistula formation following the intervention represented the natural evolution of the process as suppuration continued because the cyst was not removed. Four years ago the patient was reoperated upon to free her from the fistula, but the intervention failed because nothing was done about the cyst. Finally, she came to D'Errico a clinic where the cyst and fistula were successfully removed.

The second patient, a woman of 52, had developed digestive disturbances 5 years ago and a diagnosis of cyst of the right ovary was made 3 years later. She had persistent fever which was attributed to suppuration of the cyst. She was operated upon but the surgeon did not succeed in removing the cyst because of adhesions and he limited himself to opening and draining it. The natural result was a fistula, through which some hair was eliminated about 5 months later. At D'Errico a clinic the cystic mass with scars and fistula was successfully excised. However, on the seventh postoperative day the patient developed an abscess in the right iliac fossa and fever which persisted after opening of the abscess and which resisted treatment for about a month, then disappeared suddenly on the occasion of anaphylactic shock caused by the intravenous injection of antipertussis serum.

An interesting occurrence in this case was the elimination of a living ascaris through the incision in the right iliac fossa without any sign of peritoneal irritation or formation of intestinal fistula. This could be explained by an adhesion of the bottom of the incised abscess to one or more intestinal loops through which the ascaris could have made its way to the exterior without passing through the peritoneal cavity. The absence of intestinal fistula formation could be due to the small diameter of the worm (about 2 mm.) and to the thickness of the tissues separating the bottom of the abscess from the intestinal lumen and the varying consistency and structure which allowed spontaneous closure of the small break in the intestinal wall.

In both cases histologic examination of the removed mass confirmed the diagnosis of suppurating dermoid cyst established preoperatively on the basis of expulsion of hair through the fistulas.

RICHARD KEMEL, M.D.

**Considerations on the Krukenberg Type of Ovarian Tumors** (Considerations sur les tumeurs ovariques type Krukenberg) P. SARBU, V. VASILIU AND E. MESTER. *Gyn absi Par.*, 1948 47 178

A woman of 36 was admitted with an abdomen the size of a full term pregnancy. She complained of respiratory disturbances, loss of weight, difficulty in walking, and amenorrhea. Six months previously she had been operated upon for an inoperable tumor of the stomach with pyloric stenosis for which a gastroenterostomy had been performed. The amenorrhea had started a month before this operation and the abdomen had begun to increase in size shortly after the operation. Examination disclosed ascites and a hard, knobby, fixed tumor which reached under the costal margin and into the pelvis. Exploratory laparotomy revealed 2 tumors without adhesions; one involved the right ovary and was the size of a child's head, the other came from the left ovary and was the size of a large orange. Both were easily removed. Examination of the upper part of the abdomen showed the pyloric tumor surrounded by an epiploic mass. The abdomen was closed without drainage. Roentgen treatment was followed by slight amelioration of the general condition, but this did not persist because the gastric disturbances returned gradually. Histologically the tumors presented adenocarcinomatous formations of gastric type and Krukenberg's signet ring cells in a sarcomatoid stroma.

All authors now agree in considering this ovarian tumor as a metastatic localization of a tumor of the breast, the biliary tract, the colon, or the stomach especially of the last. Disagreement starts in discussion of the route by which the ovary is involved and the circulatory, retrograde lymphatic, and transperitoneal routes have all had their supporters.

The histologic characteristic of these tumors is the presence of signet ring cells and of pseudoglandular formations of digestive type in a sarcomatous mass. The particular aspect of these epithelial cells is due to compression by the surrounding sarcomatous tissue. The presence of mucus and the mucicarmine reaction are not pathognomonic because mucous degeneration characterizes the evolution of most carcinomatous cells. The frequency of Krukenberg tumors among the solid tumors of the ovary is relatively high. From 20 to 25 per cent of the solid ovarian tumors are metastatic. The Krukenberg type of ovarian tumor is malignant despite the false impression of benignancy imparted by its mobility at operation. Malignancy of the tumor can be accepted in the presence of ascites, bilaterality, cachexia, and associated metastasis whether peritoneal, epiploic, or of other type.

Most authors recommend extirpation of the tumors followed by total hysterectomy and roentgen therapy, some oppose surgical intervention claiming that extirpation of the metastases stimulates the primary tumor; the present case seems to confirm this opinion.

Present knowledge of Krukenberg tumors suggests two practical considerations. Whenever hard bilateral ovarian tumors are found in the course of an operation, surgical and roentgen exploration of the digestive tract is indicated in search of the primary tumor. In view of the tendency of tumors of the digestive tract to metastasize, the question arises whether in gastrectomy for neoplasm it would not be advisable to extirpate the ovaries as a prophylactic measure, especially before the menopause.

RICHARD KEMMEL, M.D.

### MISCELLANEOUS

**The Value of Celioscopy in Gynecologic Diagnosis**  
(Il valore della celioscopia nella diagnostica ginecologica). G. VECCHIETEL. *Qued. d. n. sciet. ginec.*, 1947, 96.

Celioscopy or peritoneoscopy introduced by Kellung in 1900 has been found by the author to be a valuable addition to the diagnostic armamentarium in gynecology.

The dangers of the method can be avoided by strict observance of the rules.

To explore the female reproductive organs, it is necessary to place the patient in Trendelenburg's position and the uterus in anteversion and elevation by means of an intravaginal probe.

The diagnosis by means of celioscopy was correct in 97.05 per cent of 70 cases in which the method was employed in the gynecologic clinic of Parma.

The method is of particular value for the diagnosis of ectopic pregnancy, follicular or corpus luteum cysts, inflammatory processes of the adnexa, genital malformations, and ovarian tumors.

If a small ovarian cyst or an accumulation of pus is encountered, an immediate injection of penicillin or sulfadiazine locally avoids complications.

The insufflation should be done slowly; the intra-abdominal pressure should be measured with a manometer and the injected gas should be sterile.

Of the different gases, oxygen is recommended because it is well absorbed and is nontoxic, but a danger is present when electrocautery is employed. The author uses Palmer Solari's celioscope. The use of the uterine probe is contraindicated in the presence of suspected or certain pregnancy, inflammatory or neoplastic changes of the endometrium, or imperforated hymen. The examination is performed under local anesthesia because a general anesthetic causes an abolition of reflexes so that the early signs of gas embolism, such as attacks of cough, may be suppressed. The celioscope may be introduced in the lower midline of the abdomen or through the posterolateral cul-de-sac, with the patient in the knee-chest position. The total amount of gas injected should

not exceed from 3,000 to 5,000 c.c., not more than from 500 to 700 c.c. being injected per minute. The pressure should not exceed 30 to 35 mm. mercury.

As to contraindications, caution is advisable in the presence of cardiopathies, especially those involving the myocardium. According to some authors, the presence of acute inflammatory processes is considered a contraindication, but the writer found the method not only innocuous but extremely valuable in the differential diagnosis of appendicitis and acute salpingitis. The method should not be employed in the presence of a diaphragmatic hernia because communication may exist between the peritoneal and pleural cavities. Hemorrhagic diathesis also forms a contraindication. JOSEPH K. NARAY, M.D.

**Surgical Experience in 51 Cases of Genitoabdominal Tuberculosis** (Nuestra experiencia quirúrgica sobre 51 casos de tuberculosis genitoabdominal). C. FERNÁNDEZ RUIZ. *Rev. esp. pat. Med.*, 1948, 5, 13.

It is the author's belief that tuberculosis of the female reproductive organs is much more frequent than is generally assumed. He reports 51 cases in which the diagnosis was verified at the operation and ascertained histologically.

The ages of the patients ranged from 19 to 59 years. Twenty-two of the patients were in the third, 21 in the fourth, and 7 in the fifth decade of life and 1 was older than 50 years. Forty patients were married and 11 were single. Of the 40 married women 31 were sterile. The following symptoms were present in descending order of frequency: dysmenorrhea, leukorrhea, oligomenorrhea, and menorrhagia.

The correct diagnosis was made in 9 cases or 17.6 per cent. Hysterectomy and removal of the adnexa were done in 35 cases while various conservative procedures were employed in the remaining 16 cases. The postoperative mortality was 3.0 per cent. One patient who died had had an extensive suppurative peritonitis and the other had developed an exacerbation of his pulmonary symptoms.

In 8 cases suppurative peritonitis was present. In descending order of frequency, adhesive adnitis, pyosalpinx, and obstructive nodular salpingitis were found. In 5 cases the uterus, tubes, and ligaments were involved.

A primary focus of infection in the lungs could be found only in 7 cases. In 2 Pott's disease was found, while in the remaining cases clinical and x-ray examinations failed to reveal the primary focus, which possibly was located in the abdominal lymph nodes.

Blood counts and determination of the sedimentation rate did not prove of any diagnostic value. The association of genital tuberculosis with other pathologic conditions of the same organs creates diagnostic difficulties. Fever in the past history should arouse suspicion. Amenorrhea in young persons should not be treated with hormones until a clinical and x-ray examination of the lungs has been done. Aggravation of dysmenorrhea by endocrine products justifies a suspicion of the tuberculous character of the condition.

## GYNECOLOGY

The author's institute lacks an x ray apparatus and therefore his treatment is exclusively surgical. The type of operation varies according to the condition from unilateral salpingectomy or oophorectomy to complete hysterectomy and removal of the adnexa.

In cases in which the process is very extensive postoperative irradiation is advised by the author. Heliotherapy in the form of sunbaths is also a valuable therapeutic adjunct. JOSEPH K. NARAT M.D.

**A Contribution to the Study of Endometriosis in Mexico (Contribución al estudio de la endometriosis en México)** MARIO MADRIZ BARRAL. *Ginec. Obst. México* 1948 3 13.

The author reports his work on endometriosis during the past 2 1/2 years as chief of a large gynecological service. He reviews the terminology and classifications of Sampson of the American school, and of Calatroni in Argentina who represents the German school.

The author is of the opinion and proposes that the classification of endometriosis should be (1) primary, for the lesions localized in the wall of the uterus and having anatomic continuity with the normal endometrium and (2) secondary for all lesions localized outside of the uterus and without continuity with the normal endometrium.

His statistics have been gathered from 1,483 laparotomies for gynecologic diseases. Thirty cases are classified statistically. The history symptoms pathology diagnosis and treatment of endometriosis are discussed.

It is to be noted that there were no deaths in this series, and no recurrences in the group some of the cases having been followed for 2 years.

W. FOSTER MONTGOMERY M.D.

**Surgical Treatment of Rectal Complications of Radiotherapy for Cancer of the Uterine Cervix; Possibilities of Sympathetic Surgery (Traitement chirurgical des complications rectales de la radiothérapie pour cancer du col utérin. Possibilités de la chirurgie sympathique)** M. DARGENT and L. EICHLER. *Lyon chir.*, 1948, 43 199.

The serious rectal complications consist of the rectitis syndrome due to craterlike ulceration of the anterior aspect of the rectal ampulla 5 cm. above the anal canal or to inflammatory stenosis with thickening of the entire rectal wall or its anterior half. The syndrome of established stenosis which is annular, fibrous, and generally well tolerated and a rectovaginal fistula which may follow the phase of acute stenosis and is located from 4 to 6 cm. above the anal canal. These complications do not necessarily follow one another although the more grave rectitis results in stenosis or fistula there is annular stenosis which has developed insidiously. The complications may be associated with stenosis at the rectosigmoid junction or along the colon and lesions of the small intestine or with neoplastic evolution in the rectovaginal wall, the rectal sheath and mucosa, or the lymph nodes.

Some of the rectal complications are due to technical deficiencies (turning of the colpostat, slipping of the intrauterine tubes excessive roentgen treatment of the perineal area) others are due to radionecrosis of the pelvic tissues favored by infection and previous surgical trauma.

The authors found that the association of artificial anus and chemical or surgical section of the lower left sympathetic chain affords temporary or permanent relief to patients with grave perirectal syndromes that an artificial anus alone is effective in 80 per cent of these patients, and that the formation of a rectovaginal fistula itself generally results in spontaneous disappearance of the pains. This raised the question whether the operation on the sympathetic chain alone would be sufficient and nullify the need for an artificial anus. Five serious cases in which unilateral or bilateral low lumbar sympathectomy was performed are reported.

Early results showed that this intervention had modified the threshold of pain but had not suppressed it completely. The passage of the old and hard fecal masses produced enough trauma to awaken the pain but normal defecation even of very solid material did not cause pain subsequently. This sedation was demonstrated by digital examination of the rectum which became possible at the end of the first week and revealed definite softening of the walls. In 3 of the cases a rectovaginal fistula formed from 5 days to 1 month after the operation and could be attributed only to the softening of the tissues. This was particularly clear in a case of pre-existing fistula which was obliterated by a cardboardlike block and exuberant granulations of rectal mucosa. It became manifest on the fifth day after the passage of feces.

Three months after the appearance of the fistulas the stenosis had completely changed the exuberant granulations and the perirectal induration had disappeared and the fistulas opened onto a supple annular stenosis which admitted the index finger. Radical operation then was successfully carried out on the fistulas.

Evidently there are mixed radionecrotic and cancerous stenoses in which reversibility is out of the question and it is probable that in these cases sympathetic surgery may show a good temporary result but an artificial anus will soon become necessary because of the inevitability of the patient reveals that cause of the infiltration of the patient reveals that conclude if observation of the infiltration of the sympathetic chain is sufficient to obtain results, the surgeon must be satisfied with it and reserve surgery for the cases in which success is only temporary the pains become intolerable and intestinal obstruction occurs.

RICHARD KEMMEL, M.D.

**Torsion of Uterine Adnexa and Acute Abdominal Syndrome (La torsione degli annessi uterini nel quadro dell'addome acuto)** BRUNO PARIBIO. *Ginec. Obstet.* 1948, 55 1.

Five cases of torsion of the normal female adnexa are reported. In 2 patients it occurred during pregnancy.



nancy and in 3 after the period of pregnancy. In 4 the torsion occurred in the abdomen and in 1 within the sac of a femoral hernia. Two were located on the left, and 3 on the right side. In each instance the torsion produced very acute symptoms. In 1 case the diagnosis of the referring physician was ectopic pregnancy; another abdominal colic of unknown origin; in the third, strangulated left femoral hernia; and in the 2 last cases, acute appendicitis.

The gynecologic examination proved very valuable for the correct diagnosis.

In some instances of this type the torsion may subside spontaneously or it may recur. Occasionally a spontaneous amputation of the twisted organ may take place.

An early operation is indicated as soon as the diagnosis of torsion has been made.

As to the mechanism of torsion the author believes that anatomic conditions serve only as predisposing factors and that the functional disturbance of nerves and blood vessels is mainly responsible for the occurrence of the condition.

JOSEPH K. SARAT, M.D.

**Meigs' Syndrome** (Le syndrome de Meigs). P. FURCK BAETARIO. *Gyn. obs. Par.* 948, 47-50.

The author reports the case of a thin, tired, and dyspneic woman of 66 years, who had an effusion occupying half of her right pleural cavity and an ascites in which a large ovarian tumor floated. The diagnosis of Meigs' syndrome was made and confirmed at operation. The tumor which belonged to the right ovary and weighed 300 gm. was removed and recovery was uneventful. The ascites did not reappear after the operation, and the pleural cavity which had been punctured 3 days previously did not contain any trace of fluid 11 days after the intervention. Histologically the tumor was an ovarian fibroma with myxomatous changes and partial fibrinoid de-

generation. Its surface did not present the slightest vegetation capable of explaining the ascites.

Despite its relative rarity (46 published cases) the syndrome constitutes a clinical entity which should be well known. Systematic search for a pleural effusion in cases of ovarian tumor with ascites will aid in the diagnosis. The absence of blood or of tumor cells in the fluid obtained by pleural puncture will allow correcting the diagnosis of vegetating ovarian tumor with pleural metastasis which may have been made and will completely change the prognosis. Of additional diagnostic interest is the fact that the pleural effusion occurs very frequently on the right side: among the 46 published cases the hydrothorax was on the left side in 5, bilateral in 9, and on the right in 31. As often observed, the present case began with pleural effusion which because of its tendency to recur alerted the attending physician. The rapidity and abundance of its reproduction constitute an important sign of the syndrome.

The ovarian tumor is rarely the size of that found in the author's patient. It may not exceed the size of a nut and is then discovered only during the operation after the surgeon has evacuated the ascites.

The association of ascites with ovarian fibroma is frequent: it occurs in 50 per cent of the cases. This is far from the rarity of the syndrome of Meigs. The question arises why ovarian fibroma is accompanied by ascites while uterine fibroma is not? Some authors have attached a real pathogenic value to the secretion of the cubical epithelium which covers the ovarian fibroma. This theory is alluring but does not solve the second problem: why is the fibroma associated with ascites and hydrothorax? This association is not a coincidence: there is here a relation of cause and effect as removal of the fibroma eliminates at the same time the ascites and the hydrothorax. Unfortunately the pathogenic problem of the remote action of ovarian fibroma on the pleural serosa remains unexplained.

RICHARD KEMPT, M.D.

# OBSTETRICS

## PREGNANCY AND ITS COMPLICATIONS

**Double Ectopic Pregnancy In One Tube** DYRE TROLL. *Acta obst. gyn. scand.*, 1948 47 395

A case of double pregnancy in a single tube is presented. The patient had a fairly typical history of ectopic gestation although the diagnosis was some what difficult to make. Approximately 6 weeks after the onset of her symptoms the diagnosis was af firmed by operation at which time the right tube and a portion of the right ovary were removed.

On pathologic examination there was marked en largement of the fimbriated portion of the tube with a small area of rupture. Microscopic examination confirmed the presence of a pregnancy in this area. The isthmus of the tube was likewise distended but there was no evidence of rupture present. On microscopic examination this area was found to con tain chorionic villi.

It is stated that there were approximately a hun dred similar cases reported in the literature. Several factors might account for the difference in the size of the pregnancies, one being superfecundation and another being the local conditions of growth which may permit one portion of the tube to grow more rapidly than another portion.

JAMES F. DONNELLY, M.D.

**Fifty Four Deaths Occurring in Pregnant Patients Who Had Hypertension** ROBERT A. ROSS, S. S. LAMBERT, W. L. THOMAS, and F. B. CARTER. *Am J Obst.* 1948 55 591

The authors article is based on an analysis of charts and records (from Duke Hospital, Durham North Carolina) of 54 patients who had blood pressures above 140/90 and who died during pregnancy or in the immediate puerperium. The purpose of this study was twofold: first to select facts from the records which would be helpful in estimating the prognosis of similar cases in the future; second to analyze and consider the different methods of man agement as a guide to future therapeutic approach in hypertensive patients.

The steady increase in the relative importance of hypertension in pregnancy as a cause for maternal mortality is in keeping with the increase in chronic vascular renal disease as a cause of death in the gen eral population.

The elevated blood pressure was the one common denominator in all of the patients. Other factors varied considerably so that it was impossible to clas sify the exact pathologic process. The authors learned that no single factor is of great practical im portance and that the seriousness of the whole clin ical picture should be considered in the management of hypertensive patients. They believe that help from all sources is important and the simpler labora tory tests are worth while.

The fate of the infant is a most important consid eration in any pregnancy and particularly so in pregnancies involving such sacrifices as those pre sented in the study. Only 17 of 58 infants survived the neonatal period, which is not a fair ratio for the risk of 58 (maternal) lives.

The hypertensive woman with an enlarged heart, albuminuria, and in whom changes in the optic fun di have occurred has a poor prognosis when preg nant. Serious consideration of interruption of the pregnancy by the most conservative means should be given in such cases regardless of the stage of preg nancy and contraceptive measures should be sug gested.

JOHN R. WOLFF, M.D.

**Nonsegmentation of the Nucleus of Neutrophil Granulocytes in Toxicooses of Pregnancy** (Sull' insegmentazione del nucleo dei granulociti neutrofili nelle tossicosi gravidiche) UMBERTO BRACALE. *Arch. obst. gyn.*, 1948 53 31

This study was made on 20 subjects, of whom 12 had eclampsia (10 during pregnancy and 2 in the puerperium), 6 pre-eclampsia and 2 premature toxic detachment of the normally inserted placenta. In all patients before delivery a red and white blood cell count was made as well as a differential count of the neutrophil granulocytes with segmented nucleus and nonsegmented nucleus, the eosinophils, mast cells, lymphocytes and monocytes. In addition in each formula the neutrophil coefficient of nuclear nonsegmentation of Mas y Magro was calculated by dividing the number of nonsegmented neutrophils by that of the segmented neutrophils, the normal value being between 0.05 and 0.06. Similar studies were made on the subjects 3, 5, 7 and 10 days after delivery.

The first fact observed was the increase of the non segmented forms with a Mas y Magro coefficient generally above normal in only 6 cases were about normal values found. In pregnancy there is a leuco cytosis and generally a deviation of the granulocytes to the left. Those who have studied the percentage variations of nonsegmented neutrophils during preg nancy have found differences ranging up to 10 per cent in the absence of puerperal complications. Therefore it should be remembered that as a result of pregnancy itself there is an increase in the rate of nonsegmented neutrophils, the origin of which is probably connected with the leucocytosis of preg nancy. However if in the picture of leucopoietic hyperactivity it is possible to explain an increase in the segmented forms it is more difficult to interpret 4 cases in which persistent peripheral leucopenia was opposed to a progressive increase of the nonseg mented granulocytes. In addition some segmented and nonsegmented granulocytes in 2 of these cases showed nuclear vacuoles and pyknotic chromatin condensation. Undoubtedly in these cases (eclamps-

sia in the puerperium) the blood picture indicates a myelotoxic condition with degenerative cellular damage of the maturing elements.

In other cases, besides the increase in the rate of nonsegmented elements, there was a leucocytosis which has remained nearly unchanged in successive examinations while the nonsegmented neutrophils decreased.

Only 3 cases presented very high rates of nonsegmented neutrophils with a Mas y Magro coefficient up to 0.97. These were cases of severe infectious complications in which the leucocytosis ran high. Therefore the infective state, in addition to the toxicosis of pregnancy, must be taken into account. In these cases, 2 of which were subjected to vaginal intervention and 1 to cesarean section which was followed by a large suppurating hematoma, a massive introduction of immature elements into the circulation must be accepted rather than an inhibition of maturation by the toxicosis of pregnancy.

RICHARD KEMPL, M.D.

### LABOR AND ITS COMPLICATIONS

**Protrusion of the Acetabula as a Complication of Labor.** JEAN PETERSEN. *Acta radiol. Stockh.*, 1948, 39, 205.

The author discusses the etiology of protrusion of the acetabula and presents a case in which this condition resulted in prolongation of the parturition and delivery in a 32 year old primipara. The course of the parturition, even for the patient's age, was rather protracted (about 45 hours). The roentgen examination revealed the fetus in cephalic position. The head showed evidence of accommodation and a rather large segment was seen below the pelvic inlet. There was bilateral distinct protrusion of the acetabula, with projection into the pelvic lumen of about 1 cm. on the right side and a little less on the left. The pelvic measurements (by the simple geometric method) were anteroposterior diameter 7.9 cm, right oblique diameter 11.9 cm., left oblique diameter 12.9 cm., transverse diameter 3.1 cm., and the smallest distance between the acetabula, 10.2 cm.

The skull of the child revealed pressure traces which suggest that the protraction was due to protrusion of the patient's acetabula.

FRANK L. HUSKEY, M.D.

**The Fate of the Living Viable Babies in Extrauterine Pregnancies.** MAX SUTER and CLEMENT WICKNER. *Am. J. Obst.*, 1948, 55, 489.

This article was written with the idea of determining as nearly as possible from the limited clinical material available at the Charity Hospital of Louisiana, New Orleans, and from a survey of the literature the fate of the viable babies delivered from extrauterine pregnancies. Only cases of infants born living after 28 or more weeks of gestation were selected.

Forty-one cases are tabulated from the literature to supplement those previously summarized. Four

new cases of extrauterine pregnancies with living, viable babies are reported from the Charity Hospital of Louisiana. Their case histories are abstracted.

Only about one-fourth of all the extrauterine pregnancies diagnosed after the fifth month of gestation will result in viable living babies. About one-third of all these living viable babies will have major or minor deformities including those which were incompatible with life and approximately half will survive 8 days or more.

JOHN R. WOURT, M.D.

### PUERPERIUM AND ITS COMPLICATIONS

**Early Rising after Delivery.** EDWARD L. CORRELL and JOSEPH J. MCELLEN. *Am. J. Obst.*, 1948, 55, 768.

On thousand patients at the Henrotin Hospital, Chicago, Illinois, were allowed up on the sixth postpartum day or earlier. Eighty per cent of these patients were allowed up prior to the fifth day and 30 per cent were allowed up prior to the third day. Fifty three of these patients had a cesarean section. The remainder had vaginal deliveries with the usual incidence of operative procedures.

These patients were apparently in much better condition at the time of discharge than if they had remained in bed for 8 or more days. The patients expressed a sense of well-being and a feeling of general good health earlier than those allowed to remain in bed for a longer period. They were in a position to adapt themselves more readily to their daily household routine.

Wound healing following episiotomy was not adversely affected nor was the morbidity increased. Urinary retention did not occur in any case, and postpartum cystitis and pyelocystitis were at a minimum, 3 cases being established by clinical and laboratory methods. No case of thrombophlebitis occurred among the patients delivered vaginally. The rate of involution of the uterus was increased. No case of uterine prolapse occurred.

The postoperative course following cesarean section was more nearly uneventful. Distention was infrequent. The necessity for catheterization and enemas was lessened when the patient was up to the toilet on the first postoperative day. One case of thrombophlebitis occurred in this group.

The authors believe that early ambulation is of distinct benefit in the immediate postpartum period. When necessary because of overcrowding the patient may be discharged from the hospital earlier than heretofore with a greater margin of safety. The authors express a caution as to the possible late gynecological complications of this early ambulation, such as prolapse and relaxation.

JOHN R. WOURT, M.D.

**Immediate Postpartum Hemorrhage Due to Retained Secondaries.** B. H. CARROLL, H. H. MERRITT, and O. H. STONE. *Am. J. Obst.*, 1948, 55, 620.

Excessive blood loss in the third stage of labor is the forerunner and the cause of much of our maternal mortality and morbidity. The authors believe that

the most frequent cause of postpartum uterine bleeding is faulty separation or retention of parts of the secundines. The purpose of this article is to record the blood loss the clinical course and the treatment of 115 private patients in whom retained placenta membranes or both was the cause of the hemorrhage. The method and apparatus used in collecting blood is described.

The customary method of estimation is notoriously deceiving and inaccurate. Accurate measurement of blood loss may be used as an early objective sign which sharply identifies the condition of the patient and also justifies early removal of retained tissues to control uterine bleeding. When 500 c.c. of blood or danger zone, there being an associated increased number of clinical complications. With one exception the morbidity mortality shock, and need for chemotherapy occurred in patients who had lost more than 500 c.c. of blood. Moreover blood loss over 500 c.c. was associated with a decreased ability of the mothers to nurse their infants.

Retained tissue was the cause of the immediate postpartum uterine hemorrhage in all of these cases. Early manual removal of this retained tissue permitted normal contraction of the uterus and arrested hemorrhage. The authors describe their method of manual removal of tissue. Manual invasion of the uterine cavity was not associated with a high incidence of morbidity. It is believed that infection is more likely to develop in cases in which retained pieces of tissue are left in the uterus.

A real and noticeable clinical response was observed when the blood loss was promptly replaced. Thirty three per cent of the patients were transfused. It was the authors' opinion that more transfusions could have been given with benefit. The therapeutic action is both prophylactic and curative.

JOHN R. WOLFF, M.D.

**Motor Difficulties of Neurological Origin following Delivery** (Troubles moteurs d'origine nerveuse consécutifs à l'accouchement.) J. BRETT *Rev f gyn Obs.*, 1947, 42, 354.

After reviewing the French literature on nerve injuries occurring in pregnancy or following delivery, the author reports 3 such cases. All 3 patients had difficult forceps deliveries and upon awakening from anesthesia complained of pain in one or both legs. Neurological examination revealed pain, sensory nerve disturbances, muscle weakness, absent or impaired reflexes and foot drop.

Analyses of the type described have a sudden onset. As a general rule the patient is anesthetized for an operative delivery. Upon awakening from anesthesia, she complains of weakness, although this may not be noted until she attempts to walk. These paralytic are the results of injury to the external popliteal nerve, the internal popliteal nerve or the roots common to these two nerves.

The end results are variable. In most cases recovery is favorable and rapid. In certain cases

however convalescence is prolonged and weakness and foot drop may persist for years.

In these 3 cases and in those reported in the literature prolonged labor late engagement at the end of dilatation and a difficult forceps delivery were the usual story. The author discussed the dangers of applying the posterior blade of the forceps at the level of the promontory.

Injuries to the lumbosacral trunk or to the nerve itself may result from prolonged pressure by the fetal head, mechanical injury by the forceps blade, pressure from extravasated blood or compression by scar tissue.

The usual treatment consists of electrical stimulation and the administration of vitamin B. If a similar case should occur the author intends to resort to rapid surgical intervention to decompress the nerve by incision of the pelvic aponeurosis.

CRAIG W. MUCKLE, M.D.

## NEWBORN

**Dry Gangrenes of the Newly Born** (Les gangrènes sèches du nouveau-né.) L. CLIMIX AND J. BRETT *Gyn Obs.*, Par., 1948, 47, 304.

The authors report a case of spontaneous amputation of the two lower extremities which began during the immediate postnatal period and presented the following similarities with previous descriptions of cases and with classical concepts of the disease. The lesions were bilateral, the clinical evolution was toward elimination of the involved tissues and there was complete absence of deleterious repercussion in the general condition of the patient. However the extent of the involvement was particularly serious as it ended in elimination of the two legs while in other reported cases of involvement of the extremities the lesions often involved only the skin and part of the subjacent soft tissues, allowing attempts at surgical repair. The notable fact about the case was that the authors were able to observe the beginning and the partial regression of the primary lesions which appeared about 24 hours after birth when the base of the trunk, the prepuce and the scrotum became the site of cyanotic plaques which disappeared later. In the lower extremities the cyanosis was localized to a segment having the form of a cuff below which there was absence of circulation with lividity but without cyanosis. The stage of phlyctena which was most frequently observed by other authors appeared only several days later in this case.

At about the same time the authors also observed 2 newborn infants with local loss of substance of the scalp which was in the course of healing at birth. These 2 cases seemed to present minor forms of the ulcerous disease with an intrauterine beginning described by Ombredanne and Lacassie.

The pathogenesis of these accidents is not clear. The classical role played by amniotic cords so often incriminated must be rejected while an infectious origin is out of the question. Traumatism in the course of delivery has been accused without factual

basis. The most probable cause seems to be vascular impairment. The authors have made various sections of the eliminated segments of extremities and found discrete vascular lesions, dilated veins but no thromboses, intact arteries, and absence of the popliteal artery. In connection with the latter it is possible that this arterial segment was missing congenitally, but then why should the disturbances have occurred only after birth? It would seem that the hypothesis advanced by Fèvre corresponds best to the observed facts: there may have been a primary local impairment of the capillaries with resultant local ischemia and a secondary extensive process. Perhaps an important role in these accidents should be attributed to the sympathetic nervous system.

RICHARD K. FELL, M.D.

### MISCELLANEOUS

**Maternal Measles, Mumps, and Chickenpox as a Cause of Congenital Anomalies.** M. J. FOX, E. R. KRAMER, and J. L. TERRELL. *Lancet* Lond., 1945, 746.

The association between the contraction of rubella by the mother in early pregnancy and the development of congenital defects in the offspring is discussed. Gregg (1941) reported 78 such anomalies in Australia, and Swan (1943, 1944, 1946) reported 101 similar cases in Australia. Since then, many reports have accumulated.

The most common defects noted were cataracts, heart disease, deaf-mutism and dental abnormalities. Others were microcephaly, microphthalmos, harelip, cleft palate, pyloric stenosis, spina bifida, mongolism and nevus.

Swan (1944) suggested from his findings that 100 per cent of women contracting rubella in the first 2 months and 50 per cent contracting it in the third month would have defective children. These workers as well as others did not cite the number of women with rubella whose offspring had no congenital defects.

The question is raised whether other infectious diseases, particularly those due to a virus, may cause similar defects. Except for the work of Aycock and Ingalls (1946) with poliomyelitis the authors found no report dealing with numerical probability of anomalies following maternal virus diseases other than rubella. Of 131 pregnancies associated with poliomyelitis which were studied by Aycock and Ingalls 33 ended in abortion, miscarriage, stillbirth or death of the infant shortly after birth. Of the remaining 98 children, one had clubfoot and another heart disease; their mothers having had poliomyelitis in the second and third months of pregnancy respectively.

The present study was undertaken to determine the numerical probability of anomalies in children born of mothers who had measles, mumps, or chickenpox in pregnancy. These diseases were chosen because each is caused by a filterable virus, each is common, and in Milwaukee each is legally notifiable to the Health Department.

In the 4 years from 1942 to 1945 there were 18,817 cases of measles, 14,014 cases of mumps and 26,355 cases of chickenpox, with the reports showing 31% in 100 cases of measles, 35% cases of mumps and 77 cases of chickenpox.

Public health nurses visited all of the patients; so were available many had moved because of the war or housing shortage. Only 54 per cent of the married women with measles, 70 per cent with mumps, and 68 per cent with chickenpox were located and interviewed. Dental defects were not included and questionable degrees of mental retardation were not recorded. Such congenital abnormalities as cataract, deafness, heart disease, cleft palate and harelip were specifically investigated. Each child reported to have a congenital defect was examined by one of the authors. Many defects were found to be acquired and not congenital such as otitis media and rheumatic heart disease.

Of the married women 346 had had 580 children before they contracted any of the three diseases. 6 of these children had congenital defects. These same women had 90 live children after recovering from their virus disease. Of this number 33 had been born of pregnancies associated with one of the three virus diseases. The remaining 76 children had been born of pregnancies which had begun after the mother had recovered from one of these diseases. There were 9 anomalies among the 76 children.

The number of children born to mothers who did not have any of the virus diseases during pregnancy was 389 plus 76 or 665. Of this group 6 had congenital anomalies, a normal incidence of 0.9 per cent.

Of the children born to 33 mothers with measles, mumps, or chickenpox during pregnancy only one had congenital anomaly. There were no defects in 22 children born after the mother had had mumps, and none in 4 children born after the mother had had chickenpox. Of the 7 children born after maternal measles, one had a unilateral harelip.

In the case of mumps, 3 children were born after mumps in the first 3 months, and 7 after mumps in the third and fourth months with no defects. With chickenpox none were born after the disease in the first 2 months and only 2 after the disease in the third and fourth months with no defects. The only anomaly in the series occurred after measles in the fourth month. The only child born following measles in the first 3 months had no anomaly. No anomalies occurred in 8 babies born of mothers having had measles, mumps or chickenpox in the first 3 months of pregnancy.

The authors state that the development of anomalies in babies born of mothers who have had virus diseases in pregnancy deserves serious study because of the handicap these serious defects impose on the individual and the economic burden on the parents and the community.

From the reports of Fox and Borton (1946) and Aycock and Ingalls (1946) the numerical incidence of anomalies in 15 children born of mothers having rubella in pregnancy was 2 or 13 per cent. In another

series by the same authors 2 of 12 infants or 17 per cent, had anomalies. In the authors' report, 1 child with an anomaly was found following 7 cases of measles in pregnancy a rate of 14 per cent. The small series, the authors believe, offers no basis for statistical study but does show the need of carefully conducted investigation.

The true numerical incidence is difficult to determine because the cases in which mothers with virus disease give birth to offspring with congenital defects are reported, whereas those in which these mothers do not have defective infants are not reported.

BYRON F. HENKETT M.D.

**Benign Trophoblastic Cell Proliferation.** C. G. TEDESCHI AND A. A. MATARZE. *Am. J. Obst.*, 1948, 55: 758.

Trophoblastic cells often invade the uterine wall in a normal pregnancy. Whenever this invasion occurs two possibilities may be present: benign trophoblastic cell hyperplasia, or a form of chorionepithelioma. Since the differentiation between these two conditions is based quite often on a matter of opinion rather than definite histologic criteria, need for less radical treatment may be recommended and many uteri are sacrificed needlessly.

In the differential diagnosis between benign trophoblastic cell proliferation and chorionepithelioma, it is believed that valid information can be obtained from the intimate structure of the cell type, mainly involved in the proliferative process. On the basis of cytologic criteria two patients were treated in a conservative manner. The final outcome proved this judgment to be correct.

The distinction between this benign and malignant condition should be based not on the invasive character of the trophoblastic type structure but entirely on the morphologic character of the malignant cell.

JOHN R. WOLFF M.D.

**Factors in the Treatment of Chorionepithelioma.** ALBERT W. HOLMAN and ELIZABETH H. SCHMIDT. *Am. J. Obst.*, 1948, 55: 639.

Confusion exists in the minds of many physicians with regard to the relation between hydatid mole and chorionepithelioma. This is due in part to vague and misleading pathologic classification. The authors

believe that the classification of chorionepithelioma should be clarified that the word chorionepithelioma should be discarded and that chorionepithelioma grades 1 to 4 should be used to replace it. Chorionepithelioma is a malignant change of the trophoblastic tissue both the Langhans' and syncytial layers may be involved.

Hydropic degeneration can occur in the chorionic villi of any pregnancy and is responsible for many abortions. For this reason alone the uterus should be curetted in every patient in whom a miscarriage occurs in the first trimester of pregnancy and the curettings should be examined microscopically so that the early abortion of a hydatid mole will not be overlooked and a beginning chorionepithelioma may not be unsuspected.

Every patient who passes a hydatid mole must be suspected of harboring a chorionepithelioma. After a woman has passed a mole she should be curetted immediately and the curettings should be examined. Negative findings from curettage mean nothing and the urine of the patient should be examined for chorionic gonadotropic hormones by the Friedman test at intervals, until a year has intervened since the passing of the mole.

The primary, the most frequent, and the cardinal symptom of both hydatid mole and chorionepithelioma is bleeding. Any bleeding during pregnancy or other signs of threatened miscarriage must cause the thought of hydatid mole to be borne in mind. Likewise any bleeding following miscarriage or pregnancy must cause chorionepithelioma to be suspected.

The ultimate clinical diagnostic method for chorionepithelioma is the biologic pregnancy test and if this test is positive 2 weeks following pregnancy or the passage of a mole, hysterectomy should be performed in the absence of palpable lutein cysts. Roentgen examination of the lungs should always precede hysterectomy for chorionepithelioma because pulmonary metastases are frequently present before they are suspected and if recognized early may be treated by roentgen radiation. The ovaries should be removed only when involved by the primary growth, or by metastases. The vagina and vulva should be examined carefully before hysterectomy is carried out because metastases to the vagina frequently occur very early.

JOHN R. WOLFF M.D.

# GENITOURINARY SURGERY

## ADRENAL, KIDNEY AND URETER

**Unusual Case of Adrenal Carcinoma.** L. R. BROTTEN AND JOCKEY PATTERSON. *Brit. M. J.* 943, 731

The authors reported a case of adrenal carcinoma because it showed the general clinical appearance of typical group 1 virilism and in the later stages manifested disturbances in the carbohydrate and steroid metabolism of a particularly striking order.

Furthermore this case afforded an opportunity for the successful application of a newly devised urinary color test for distinguishing between adrenocortical carcinoma and marked adrenal hyperplasia. As a test of malignancy the potentialities would seem to be not less than those of such acknowledged diagnostic aids as the gonadotropin assays for chorionepithelioma and the serum and phosphate excretion in prostatic carcinoma. ROBERT TURNER, M.D.

**Massive Hydronephrosis.** HOWARD A. HOFFMAN. *J. Urol.* 64: 59, 1954

The author presents reports of the cases of massive hydronephrosis seen in the Massachusetts General Hospital, Boston, from 1911 to 1946 inclusive. Because of the relative asymptomaticity of the disorder, the frequent failure to consider it in the differential diagnosis of abdominal masses, the ever-present danger of rupture and shock, the frequent ill-advised performance of laparotomy and the high incidence of mortality, it was felt that a review of the entire subject was indicated. A review of the literature revealed that the total number of reported cases by the beginning of 1947 was 89, and of these a very substantial percentage were misdiagnosed. It is the author's impression that these cases are not as rare as the reports in the literature would seem to indicate, during the period studied 10 cases of massive hydronephrosis were found, an incidence of approximately 3 per cent of all hydronephroses admitted to that hospital in that 6 year period. From this study it was found that the incidence extended through all age groups. Most patients, however, were in the second, third, and fourth decades.

Four of the patients complained of ache in the flank or loin. Of the remaining 6, 3 came in with gastrointestinal symptoms thinking they had peptic ulcer, 1 came in without any symptoms to have a routine check-up for hypertension, 1 appeared with leg and groin pain from thrombophlebitis, and the last was concerned because her clothing kept feeling tight despite repeated letting-out.

On physical examination one-half the patients had a palpable mass in the flank, and that without tenderness. Of the remaining 5, 1 had costovertebral angle tenderness but no mass, and 3 gave an entirely negative physical urological examination.

Six of the 10 patients had essentially negative urine. Of the remaining 4, 3 had pyuria alone and

the other 2 had both hematuria and pyuria. Three of the infections were associated with the *Bacillus coli* and one with the *Bacillus pyocyaneus*.

Except in 1 patient with ureteral calculus, the intravenous pyelogram in no instance gave the diagnosis of massive hydronephrosis. In 6 cases it disclosed only a nonfunctioning kidney. The retrograde pyelogram, however, led to the urologic diagnosis of massive hydronephrosis in 9 of the 10 cases. In this series 9 of the 10 cases had involvement of the left side. There is no definite reason for this, and other authors have claimed that the involvement occurred with equal frequency on both sides. Without urologic study the true diagnosis was not made in any instance. The reasons for definitive surgery were not included in this report, however, in one instance it was the considered judgment of the surgeon that plastic measures were not feasible and nephrectomy had to be carried out. In 1 case permanent nephrostomy had to be done as the kidney was a congenitally solitary one.

The massive hydronephrosis was associated with distinct obstruction of the ureteropelvic junction by aberrant vessels in 2 of the 10 cases. In 3 cases organic stricture of the ureter or junction without aberrant vessels, as demonstrated. The kidney destruction was associated with ureteral calculus in 1 case. In 4 cases no obstruction was demonstrable.

It is agreed by most authors that the large majority of massive hydronephroses are congenital in origin. They can attain a large size and remain asymptomatic only when infection is absent. Uncomplicated hydronephrosis then is notoriously well-tolerated by specific symptoms. Thus the patient does not present himself to the urologist and many cases will not be seen until the sac has ruptured after some abdominal injury. When this occurs the diagnosis is quite likely to be missed and laparotomy is carried out because an intra-abdominal accident is suspected as the cause of shock.

Pyelographically the condition suggests itself by a displacement of the ureter medial and to the opposite side (as in tumor). If a ureteral catheter can be passed by the obstruction the diagnosis can readily be made. Plastic repair should be considered in each case, but it is not reasonable that such can often be carried out. The cortex has usually been irreversibly damaged and nephrectomy must be performed. When the hydronephrosis is infected and the patient is septic a 2-stage procedure may be lifesaving.

ROBERT O. BRADLEY, M.D.

**Recurrent Renal Calculi.** JAMES C. KIRKBRIDE AND JOHN N. FRUIT. *J. Am. M. Ass.*, 94: 8, 1927

The authors discussed the management of recurrent renal calculi complicating the recumbency of patients with war wounds. Only cases in which the patients were treated by operative procedures are

reported in this article. The literature on the incidence and causation of renal calculi is reviewed in some detail. The authors believe that recumbency with its attendant urinary stasis is a major causative factor of renal calculi in many militarized patients. Patients with paraplegia and with complicating vascular conditions constitute a special problem. Almost all of these patients have urological infections. It is believed that recumbency stasis and infection cause a high incidence of renal calculi. Also damage to renal tissue by infection, battle injury or surgical procedures has played an important part in the recurrence of calculi.

Because calculi act as foreign bodies causing renal damage, they should be removed by open surgery without undue procrastination. A policy of watchful observation may be dangerous. Of the 25 patients treated by operation, 12 had one previous operation and 13 had two or more previous operations. The calculi were removed from 8 patients (32 per cent) by pyelolithotomy, from 3 (12 per cent) by nephrolithotomy, from 7 (28 per cent) by nephropylolithotomy, from 4 (16 per cent) by calyceal resection and from 3 (12 per cent) by nephrectomy. Pyelolithotomy is the operation of choice, but it is rarely possible as a secondary operation. On account of previous renal surgery, the kidneys in these patients are adherent to the adjacent structures which makes exposure difficult. The subcapsular approach reduces to a minimum the damage to the kidney and adjacent organs and therefore is the preferred operative procedure.

The authors believe that the removal of renal calculi is only one phase in the management of renal calculi and may be a misdirected effort unless there is appropriate postoperative care and thought to prevent recurrence of the calculi. The regimen for the prevention of recurrence is summarized. Roentgenologic follow-up should be carried out at 3 month intervals in order to detect early recurrence.

ROBERT TURNELL, M.D.



Fig. 1. (Garcia and Rocchi) Shows the megaureter with strictures.

**Megaureter Pyeloureteral Anastomosis with a Loop for Exclusion (Megaureter Anastomosis Pyeloureteral con asa excluda) A. E. GARCIA and A. ROCCHI. *Rev argent urol.*, 1947 16 153.**

A woman aged 38 was admitted to the hospital with complaints of frequent pains in the right lumbar region of 2½ years duration. The attacks of pain were accompanied by fever and vomiting. The right flank was painful to palpation. The urine had an acid reaction and its sediment contained

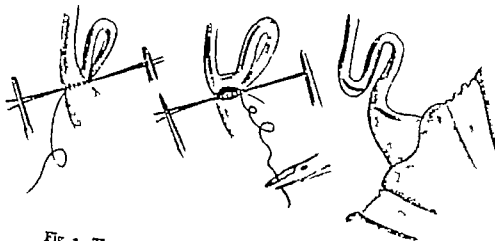


Fig. 2 The anastomosis between the renal pelvis and the ureter



epithelial cells and the usual amount of white and red blood corpuscles and micro-organisms. Retrograde ureteropyelography demonstrated a greatly dilated right ureter with angulations. The findings were less pronounced on the left side.

Under peridural anesthesia Eckhorn's incision was made, which exposed the right kidney and the corresponding ureter in its entire length. Angulations were relieved by an extensive ureteropyelolysis but the strictures remained. A longitudinal incision was made through the renal pelvis and another through the upper portion of the ureter and both incisions were united with one layer of plain catgut number 00.

The patient made an uneventful recovery. Excretory urography and retrograde ureteropyelography in anteroposterior and oblique directions demonstrated a well functioning anastomosis.

JOSEPH K. NARAY, M.D.

**Two Cases of Tumors of the Ureter.** Discussion of the Surgical Treatment (Dos casos de tumores del ureter. Consideraciones sobre la terapéutica quirúrgica). ALBERTO E. GARCIA AND JOSE CARAL. *Rev. argent. urol.* 947 6 193.

The majority of tumors of the ureter are located at the lower end. Two such cases are reported by the author. The first patient a man 64 years of age was admitted with complaints of hematuria of 4 months duration. A papillary proliferation was found at the cystoscopic examination in the region of the left ureteral orifice. No dye was excreted by the left kidney during the first 15 minutes after its injection. An excretory urogram showed a left pyeloureteral ectasia. A total left nephroureterectomy with partial excision of the bladder was performed. The histologic diagnosis was paramalpighian epithelial blastoma.

The second patient 50 years of age came with complaints of hematuria of 4 years' duration. The cystoscopic examination revealed a tumor at the orifice of the right ureter. Excretory urograms demonstrated a dilatation of the lower portion of this ureter. The transvesical approach was used to remove the tumor. The histologic examination revealed numerous atypical cells and many mitoses. The conservative procedure in this case was justified because the dilatation of the lower portion of the ureter was moderate while the upper portion appeared normal.

For the purpose of ureteronephrectomy the author advocates a double incision, one in the lumbar region and the other in the lower midline.

JOSEPH K. NARAY, M.D.

**Urinary Calculi.** HAMILTON W. MCKAY, H. HAYNES BAIRD, and KENNETH LYON, JR. *J. Am. M. Ass.*, 948, 137 5.

The authors analyzed 200 cases of urinary calculi and discussed the management of ureteral stones. Of the 200 patients, 77 had renal stones, 20 had stones in the upper part of the ureter, 11 in the mid-

dle of the ureter, 90 in the lower part of the ureter and 10 in the bladder; there were 4 patients with bilateral ureteral calculi and 12 with bilateral renal calculi. The mortality rate was 0.5 per cent. Chemically the stones were composed of the following: (1) calcium carbonate, (2) calcium phosphate, (3) urates, (4) mixtures of calcium carbonate, calcium phosphate and urates, and (5) oxalate (rare).

The greatest difficulties were encountered with small rough stones in the terminal aspect of the ureter. Because of the well known difficulties, the authors devised a new ureteral open surgical technique which is described in detail. The transvesical or retrovesical approach to impacted stones in the intramural part of the ureter or just back of the bladder is believed to be of value at times. The technical steps of this procedure are also briefly outlined.

In the discussion GOLDSTEIN stated that the authors had wisely and rightfully held to no conventional procedures. He believes that the surgical policies described in the article are now in practice in most of the larger clinics. Goldstein has in the past few years gradually increased the percentage of open operative procedures for the elimination of ureteral stones.

LIVERMORE, the inventor of one of the metal instruments for the removal of ureteral stones, condemned them because they are dangerous and may damage or puncture the ureter. He believes that only ureteral catheters and flexible bougies should be used.

As to the best time to operate, this depends on the condition of the patient and the judgment of the urologist.

ROBERT TURELL, M.D.

## BLADDER, URETHRA, AND PENIS

**Total Cystectomy for Carcinoma of the Bladder** (La cistectomía total a el cancer de vesiga). RICARDO EICOLZ. *Rev. argent. urol.*, 947 6 20.

Poor results of a partial cystectomy for the treatment of infiltrating carcinoma of the bladder induced the author to employ a total prostatic cystectomy. The operation is not performed if metastatic adenopathies are present.

In 1 of 11 patients the ureters were implanted into the intestines and in 1 into the skin. In 9 patients a one-stage operation was employed for the implantation of the ureters into the intestines, while in 1 patient a two-stage operation was performed. One patient succumbed to the operation. In 8 patients a complete cystectomy was done without post-operative mortality. Two patients expired 1 year and 1 patient, 1½ years after the operation. Of the remaining 5 patients, 3 were alive 1½ years after the operation, in 1 the bladder was extirpated 20 days before this report was made and in the other it was extirpated 3 months before.

In 7 of the 8 patients, the abdominal approach was used and in 1 a combined abdominoperineal route was used.

The implantation of the ureters in the skin as a preliminary step to the extirpation of the bladder is



The fourth case was that of a woman 33 years of age who entered the hospital with an admission diagnosis of torsion of an ovarian cyst. After examination surgical intervention was advised. At operation, a retrovesical cyst was found between the layers of the broad ligament. A second one was found in the posterior layer of the broad ligament. On extension of the incision a large cyst was found on the inferior aspect of the liver.

The pelvic localization of the echinococcal cyst is never primary. It is always secondary as Devo has shown. It follows the rupture of intra-abdominal hepatic or splenic cysts. The site of the cyst may take two positions. It may be retrovesical or retrovesical and prostatic.

The superior vesical cyst compresses the bladder and causes diminished capacity with polyuria. The inferior vesical cyst causes pain on micturition and dysuria. The hydatid cysts have the same development as echinococcal cysts in other locations.

The symptoms of retrovesical cysts are polyuria and dysuria. The patient has frequent diurnal and nocturnal micturitions. The urine is rarely purulent unless a renal infection is also present.

The physical signs are certainly characteristic. The suprapubic abdominal pelvic tumor gives the impression of a distended bladder. If the cyst is vesicoprostatic, rectal examination permits the palpation of a rounded mass above the prostate. It is not possible to reach the upper limits of the mass. On rectal examination associated with hypogastric palpation one is able to obtain some impression as to the size of the mass.

Urethroscoposcopic examination, cystograms and barium enemas were used by the author to establish diagnostic criteria. The possibility of distention of the kidney pelvis and the ureter should make a renal examination advisable.

The diagnosis of hydatid retrovesical prostatic cyst is easy when it is associated with a hydatid disease background. The retroprostatic mass might suggest a prostatic abscess, but its indolence resistance that is nonfluctuant, the absence of draining pus at the urinary meatus, the ease of transverse of the urethra, the absence of temperature leucocytosis, and polymorpholeucocytosis nullifies this diagnosis. If the cyst is large, a hypogastric mass produces concluding evidence of the disease. Simple catheterization will establish that the tumor is intraperitoneal rather than due to a distended bladder. Rectal examination shows a hypogastric mass, but an intra-abdominal tumor is difficult to diagnose by rectal palpation.

X-ray examination after a barium enema helps to confirm the presence of an intra-abdominal lesion.

The Cassini test is positive for hydatid cysts and helps to establish a diagnosis.

The treatment is surgical with early intervention to prevent complications of infection, rupture, and definitive renal lesions due to compression of the ureters. The therapeutic measures are the same as they are in the other locations of echinococcal cysts.

It is a question as to whether one should evacuate the cyst with immediate closure or with marsupialization of the opening. The author favors marsupialization even though the convalescence is longer as the results are better.

A suprapubic incision is made with the patient in the Trendelenburg position. The peritoneal cavity is retracted. If intra-abdominal cysts are found, they are enucleated and the peritoneum is closed. The vesical region is then exposed and two masses are seen, the superior one the cyst and the inferior one the bladder pressed against the pubis. The superior surface of the cyst is cleared and the surrounding structures are protected by formalin compresses. The cyst is punctured and the contents are evacuated. The fluid is replaced with formalin solution which is retained for 10 minutes. The cavity is curetted and all the daughter cysts and the mother membrane are removed (if possible in one piece). The pouch is marsupialized with closure of the incision about a drain. The large retrovesical cysts are more often closed without drainage and marsupialization.

In résumé the author presented 4 cases of retrovesical hydatid cysts. The existence of intraperitoneal hydatid disease in 2 of the cases seemed to confirm Devo's opinion that these cysts have an intraperitoneal origin. The physical examination and x ray findings were presented in these cases. Sabatini advised exposure of the cyst with evacuation of its contents, lavage with formalin solution, curettage, removal of the mother membrane, and marsupialization of the edges of the sac in hydatid cysts of the pelvis.

CORRAD A. KUEHN, M.D.

Hemolysis during Transurethral Prostatic Resection. C. D. CANNY *J. U. N. Med.*, 943, 59: 17

The author points out that every urologist who strives to resect the prostate gland transurethral down to the surgical capsule knows that the operation is sometimes followed by uremia and other disturbances.

As a characteristic reaction the patient has rigor and cyanosis during or shortly after operation, nausea and vomiting often ensue and oliguria and azotemia may soon appear.

A mild, nonobstructive jaundice and an anemia more severe than would be expected from the loss of blood are typical reactions. Hypertension may occur later.

Since the type of uremia the author discusses seems to occur most often when considerable blood has been lost during or after operation the azotemia might be attributed to the spasm of the renal vessels. While this condition explains some of the features of the obscure uremia which may follow transurethral resection it does not account for the mild, nonobstructive jaundice which usually accompanies it, nor does it account for the fact that an anemia out of all proportion to the amount of blood lost by hemorrhage is often demonstrable as early as 24 hours after operation.

Emmett suggested that this phenomenon was due to the sterile water used as an irrigating fluid during transurethral prostatic resection. The sterile water may enter the prostatic veins producing hemolysis and damaging the kidneys as these organs are involved when transfusion with incompatible blood is done.

Wardill concluded that the anemia following prostatic operation was identical with that following the crush syndrome or the transfusion of incompatible blood.

Drisk hemorrhage requires the use of large quantities of irrigating fluid at high pressures to permit the operator to see more clearly. When the operation is prolonged conditions are then favorable to hemolysis. Inability to predict if a hemolytic reaction will occur may be due to the variations in the size and number of the openings made in the prostatic or periprostatic veins and the variations in the size of the veins.

The author reported the case of a man who was operated upon May 28 and expired June 9 of hemolysis following a transurethral prostatic resection. The autopsy findings showed postoperative hemoglobinemia, obstruction of the renal tubules by pigmented casts and toxic changes in the tubules with hypertrophy and dilatation of the heart from chronic passive congestion of the liver, cholelithiasis and ascites (from peritoneal lavage). The microscopic sections of the kidney were identical with those from another patient who had anemia following the transfusion of incompatible blood.

The author reviews the literature on renal insufficiency following transfusion of incompatible blood. Similar changes have been found in the kidneys after traumatic muscular ischemia, heat stroke, sulfonamide intoxication and poisoning with certain vegetable and chemical agents. Lucke has suggested the term "lower nephron nephrosis" for renal lesions of this nature. The changes in the kidneys in these conditions include vacuolation, necrosis and desquamation of the epithelium of Henle's loops and the distal convoluted tubules. Pigmented casts are found in Henle's loops in the convoluted tubules and in the collecting tubules. Hemosiderin granules are seen in the convoluted tubules. Edema and cellular reaction are found around the more severely damaged tubules. Precipitated protein may be found in the glomerular capsules which are not dilated although the tubules proximal to the casts may have dilated lumina and thinned epithelium.

It appears from experimental work that alkaline hemolytic reactions are probably harmful rather than helpful in failure.

It would seem that the deleterious effects of transfusions with incompatible blood are due to the transport to the kidneys of hemoglobin or one of its breakdown products which damages the renal tubules either by some direct toxic action, by the production of vascular spasm by plugging of the nephron or

perhaps by all three of these factors. It has been further suggested that the oliguria that accompanies these lesions is due to unselective absorption of the glomerular filtrate by the injured tubules. If hemoglobinemia alone is to damage the previously normal kidney it must be of a severe type.

Sterile tap or distilled water is usually used as an irrigating fluid in transurethral prostatic resection. If the operation is reasonably complete, many good sized veins in the operative area are opened. The resulting hemorrhage necessitates running the water clear, so that the operator may be able to see the bleeding points and secure them by hemostasis. The irrigating water now containing blood already hemolyzed in the bladder may enter the venous system and thereby produce hemolysis.

Investigative work has shown that the plasma hemoglobin averages 3.08 mgm. per cent before and 45.4 per cent after the operation. In 3 of 8 patients who developed mild oliguria, elevation of the urea nitrogen and disproportionate anemia in addition to mild jaundice was seen. The postoperative plasma hemoglobin averaged 81 mgm per cent. This would further support the view that hemolysis occurs during transurethral resection.

The treatment of the patient with severely damaged kidneys as a result of hemoglobinuria is concerned mostly with keeping him alive until natural healing processes within the kidneys can take place. Oxygen therapy seems indicated in the initial stage for vasospasm probably damages the tubules by reducing the oxygen supply.

The most accurate method of following the fluid balance in the oliguric patient is by accurately ascertaining his daily weight and giving no more fluid than is required to keep that weight constant or allow it to fall slowly.

The acidosis which usually accompanies uremia must be controlled by the administration of alkalis without overloading the patient with sodium or producing an alkalosis which may further impair the renal function. The anorexia may require tube feeding and the administration of parenteral vitamins in the early stages. Nasal suction may control nausea and vomiting. Parenteral replacement of proteins may be required and the anemia resulting from blood loss and hemolysis may demand transfusion. Peritoneal lavage may relieve the body nitrogenous waste until the kidneys resume effective function.

The solution to the problem of hemolysis following transurethral prostatic resection lies in its prevention rather than the treatment of the ensuing hemoglobinuria. The use of irrigating fluid under the lowest possible pressure that will allow the operator to see clearly is important. In order to prevent hemolysis an irrigating solution that does not hemolyze blood should be used. Saline solution or other good conductors of electricity they diffuse the current from the electrode which prevents satisfactory cutting and coagulation.

The author used 4 per cent glucose solution as an irrigating medium without hemolytic reaction. He warns that care should be taken when this solution is used in diabetic patients.

In summarizing the author states that intravascular and intravascular hemolysis may be produced during transurethral prostatic resection by the water that is used as an irrigating fluid. Hemoglobinemia probably does not harm the kidney unless the hemolysis is very severe or the kidney is simultaneously damaged by vasospasm from excessive blood loss or surgical shock, or by the transportation of bacteria from prostate to kidney by the irrigating fluid.

A hemolytic reaction may be recognized at once by measuring the free hemoglobin at the end of the operation. The reaction itself is characterized by chills, nausea, oliguria, a rising urea, mild jaundice, and by an anemia out of proportion to the amount of blood actually lost during or after the operation. The treatment consists in keeping the patient alive until sufficient time has elapsed to permit recovery of the damaged renal epithelium. The hemolytic reaction can be prevented by using an isotonic solution of a poor electrolyte such as 4 per cent glucose solution, as an irrigating medium during transurethral prostatic resection.

CORRAD A. KUTNER, M.D.

**Glycine as an Irrigating Solution in Transurethral Resection** REED M. NERBIT and STANLEY I. GLICKMAN *J Urol* Balt., 94:5, 59

Creedy believes that the anemia, marked oliguria or anuria, loss of appetite, progressive nitrogen retention and jaundice following transurethral prostatic resection is due to intravascular hemolysis. McLaughlin suggests that the syndrome is produced by the water used as an irrigating medium, which passes into the prostatic plexus of the veins during transurethral resection. Creedy noticed spurts of red urine coming from the urethral orifices during prostatic resection, and he subsequently found a high level of hemoglobin in the plasma of the patient following operation.

In order to facilitate vision when the resectionist has located into the periprostatic plexus of the veins, the level of the water reservoir may have to be raised inordinately high, to force fluid into the venous system. Varying amounts of hemolysis might result from this course of events.

Nerbit and Glickman did not observe oliguria following transurethral prostatic resection at the University of Michigan Hospital Ann Arbor during the past 16 years. However, the possibility did exist that some of the postoperative morbidity may have been due to unrecognized minor manifestations of this syndrome. None of the authors' patients manifested clinical signs of intravascular hemolysis when preoperative and postoperative samples of plasma or serum were examined.

Many investigators believe that hemoglobinuria in the presence of an acid urine results in the formation of acid hematin which mechanically blocks the renal tubules. Bing thought that the acidosis accompanying

ing the anuria may affect the respiratory enzymes of the tubular cells and account for the impaired renal function. This would provide the reason for alkalization when hemoglobinuria exists. Renal vasoconstriction induced by hemoglobinemia may result in ischemia of the tubular cells and account for their diminished function.

In Ross' opinion the fatal renal damage is probably produced by shocking levels of blood pressure and by severe and prolonged reduction of the blood flow through the kidney, the latter being accentuated by hemoglobinemia.

The reduction of alkaline reserve may be associated with methemoglobin in acid glomerular filtrate which would add to the existing tubular damage.

An isotonic irrigating solution that would eliminate the risks of intravascular hemolysis should have the following properties:

1. It must be either nonelectrolytic, or very weakly ionized. For a highly ionizable substance such as sodium chloride allows dispersion of the high frequency current and thereby inhibits its cutting properties.

2. It must be nontoxic when given locally or when administered intravenously.

3. It must be transparent so as not to interfere with visual acuity during the performance of the operation. It must be understood that any isotonic solution used as an irrigating fluid will merely suspend the red blood corpuscles and result in a slightly opaque medium rather than the clear medium produced by the use of distilled water in which complete hemolysis occurs.

4. It must be relatively cheap to permit its use in large quantity.

Creedy suggests the use of 4 per cent glucose solution and reported its use in 158 cases. This solution makes the surgeon's gloves sticky and if the operation is performed on a diabetic, careful observation of the blood sugar is required.

The authors used a 1 per cent solution of glycine in 45 cases of transurethral prostatic resection without demonstrable hemolysis. This solution was found to be abundant and cheap and it fulfilled the requirements of an isotonic irrigating solution.

The average fluid volume used in the trial series of cases was 12,000 c.c. of fluid during each operation. Thus, the glycine cost per operation was 75 cents, or if a 1 per cent solution was used (as it was in 30 patients plus 200 additional cases reported in a note at the end of the paper) the cost of the solution was only 38 cents.

A 20 per cent stock solution of glycine can be sterilized by autoclave in gallon bottles and the solution can be mixed with water when it is needed in the operating room. This method of handling the solution is much easier than making up large quantities in the dilution used at operation.

In conclusion, the authors advocate the use of from 1 to 2 per cent of the amino acid glycine as an irrigating solution to eliminate the intravascular hemolysis associated with transurethral prostatic resection.

CORRAD A. KUTNER, M.D.

**Varicocele. Surgical Technique Advocated by the Author (Varicocele. Técnica quirúrgica que preconizamos)** LUIS ARMANDO BAGLIETTO *Dis medica B Air.*, 1948 20 379.

Operation for varicocele is justified because the venous stasis exerts an unfavorable effect on the parenchyma of the testis. A diminution of the exogenous and endocrine secretions is the result.

Two conditions require operative correction (1) varicosities of the veins of the spermatic cord and (2) ptosis of the testis with secondary elongation of the scrotum. Although some workers maintain that only a correction of the varicosities is necessary the author of this article is of the opinion that an orchidopexy is also required.

The author prefers to operate under spinal anesthesia, although the general or local type may also be employed. A 5 to 6 cm. long incision is made slightly above Poupart's ligament. The superficial epigastric artery and vein are ligated and severed. A 2 to 6 cm. long incision is made through the aponeurosis of the external oblique muscle.

Fibers of the cremaster muscle are separated care being taken not to injure the spermatic artery. A 2 cm. long segment of the vein is resected. A concomitant hernia should not be overlooked. A small hernia may escape detection before the operation. This technique as compared with an incision through the scrotum preserves the lymphatic circulation and the sympathetic innervation, allows the discovery of hernia, avoids complications inherent to manipulations of venous plexuses (such as thromboembolism hematomas, chronic edema) and permits the re-establishment of a sufficient venous reflex.

The spermatic cord is lifted with a finger placed underneath and an orchidopexy is accomplished by suturing both ends of the severed vein parallel to one another. An eversion of the tunica vaginalis is employed only in the presence of hydrocele. The sutured ends of the spermatic vein are attached with interrupted sutures to the fibers of the cremaster muscle.

JOSEPH K. NARAT M.D.

# MISCELLANEOUS

**Reiter's Syndrome.** R. J. G. MORRISON and M. THOMPSON *Lancet* Lond., 1948 1 636.

The triad consisting of arthritis, conjunctivitis, and urethritis first described by Reiter in 1916 and which now bears his name, was found in 9 cases in the British troops in Western Germany and is reported in detail by the authors. A review of the literature revealed various unusual features of the so-called syndrome of Reiter. Not infrequently one or more components of the triad was absent yet the reporters believed that the disease encountered was actually a manifestation of Reiter's syndrome. It was noted that urethritis might be absent in some cases while in others there might coexist renal complications such as terminal hematuria, hydronephrosis, and chronic pyelonephritis. Recurrences were not uncommon.

A review of 9 cases by the authors revealed uniformly negative smears for gonococci except in 2 of the cases. An elevated sedimentation rate was noted as well as a leucocytosis and sterile pyuria. There appeared to be no association to dysentery. Although the etiological agent is unknown the authors believe that the disease is a manifestation of an unknown allergic phenomenon. This conclusion is somewhat substantiated by the clinical symptoms and signs of arthritis variable rashes and the increased sedimentation rate. An anemia was noted in one case but was unexplainable. In all cases there was involvement of the knee joints while in only a few of the cases were the small joints of the hands involved. While the condition varied considerably in severity from patient to patient and there was no noticeable response to sulfonamides or penicillin some benefit was apparently derived from intra venous protein shock induced with T. A. B.

PETER L. SCARDINO M.D.

**The Venereal Granulomas: A Comparative Study of These Diseases in Florida** WESLEY W. WILSON *South. M. J.*, 1948, 41 412

The venereal granulomas (granuloma inguinale lymphogranuloma venereum and also chancroid), occurring in Florida from 1942 to 1947 were studied by the authors. The diagnostic methods employed included (1) blood serologic studies to rule out syphilis (2) dark field examination for *Treponema pallidum* and other spirochetes (3) smears for gonococci, Donovan bodies, fusospirochetes, Ducrey bacilli, yeasts etc. (4) intradermal tests (Frei and Ducrey) and (5) biopsy for Donovan bodies in tissue section since not infrequently it is difficult to demonstrate these bodies in smears because of marked contamination by other organisms. Although limitations are inherent in the methods they play an important role in the differential diagnosis.

Chancroid lesions developed in from 2 to 3 days after sexual exposure. Positive smears were found in 50.6 per cent of 147 patients examined. Intradermal tests performed with commercial Ducrey vaccine were found positive in 80.6 per cent of the cases in which the clinical diagnosis was chancroid. Therapy consisted of oral sulfathiazole 4 gm. daily. The ulcerative, vegetative lesions of granuloma inguinale extended into the inguinal region, the perineum and about the anus. Lesions about the anus occurred frequently in sexual perverts. The lesions were found to occur both superficially and deep having been demonstrated in lesions of the abdominal viscera, lymph nodes and bones of the thorax. The successful demonstration of Donovan bodies adequately substantiates the diagnosis.

Of 51 patients treated complete healing was obtained in 46 (90.2 per cent) by antimonials and surgical excision. The satisfactory response to streptomycin by two failures in the series prompted the authors to advocate the use of streptomycin in preference to other forms of therapy. Twenty two of the 24 patients with lymphogranuloma venereum

had early lesions occurring most frequently as primary vulvoscaphules on the penis without bubo formation. Of the 6 female patients 4 presented ulceration of the vagina with elephantiasis of the vulva. 42 per cent of the patients showed mild to moderate reaction to the intradermal Frei test and 16 per cent of the patients had a biologically false positive Kahn test. After establishing the diagnosis, sulfathiazole was found to be the drug of choice.

PETER L. SCARDINO, M.D.

**Cancer Cells in Urine.** CARL J. SCHINDLAPF and VICTOR F. MARSHALL. *J. Urol. Balt.* 1943, 50: 399.

The results of a study of 333 patients examined by the Papanicolaou technique are reported after a 6 months period of follow-up. The cases have been arbitrarily divided into three groups: (1) those with clear evidence of genitourinary cancer at the time of examination of the urine (on the grounds of biopsy or overwhelming clinical evidence); (2) those with a strong suspicion of cancer but in which clinical and biopsy evidence was not conclusive; and (3) those in which there was no suspicion of genitourinary cancer. Dr. Papanicolaou's reports were also reduced to three classes: positive, suspicious, and negative.

In 195 cases there was no evidence of malignant cells in the urine sediment. Of these 176 or 89.8 per cent were clinically noncancerous; 8 or 4.1 per cent were clinically suspicious; and 14 or 7.1 per cent were clinically cancerous.

Fifty-three cases were suspicious according to laboratory reports, but evidence in the smear did not warrant a diagnosis of malignant neoplasia. Of these 24 or 45.3 per cent are clinically cancerous; 6 are suspicious; and 23 were clinically noncancerous.

Eighty-two cases were reported as having definite malignant cells in the smear. Of these 71 or 86.5 per cent were clinically cancerous; 8 were clinically suspicious; and 3 had no evidence of cancer clinically.

The authors caution against the clinical application of this method of diagnosis until a fairly large series has been tested against the usual data, especially biopsy.

JOSEPH E. MARSH, M.D.

**Exfoliated Cell of Cancer of the Genitourinary Tract.** FREDERICK CHUTE and DAVID W. WILLIAMS. *J. Urol. Balt.* 1943, 50: 604.

The microscopic examination of slides of urinary sediment in the search for exfoliated tumor cells requires much experience, especially as the criteria are not always definite and absolute. The tumor cells are identified largely on the basis of marked variation in size; enlarged dark hyperchromatic staining nuclei; giant nuclei; and absolute or relative increase in the size of the nuclei in ratio to the amount of cytoplasm.

The authors have selected 163 cases in which a definite clinical diagnosis was made. 109 of these patients had no malignant disease. Of these 109, 96 (or 88 per cent) were correctly called negative while 13 or 12 per cent were incorrectly diagnosed as positive. Fifty-nine patients had malignancy of the urinary tract and in 32 of these (55 per cent) the malignant disease was detected by the smear while it was missed in 27 others (45 per cent).

The cases of malignancy were first diagnosed by smear having been previously partly unsuspected. After a more urological search the tumors were located and confirmed by biopsy. The authors stress the use of fresh specimens of urine and of repeated examinations.

JOSEPH F. MARSH, M.D.

# SURGERY OF THE BONES, JOINTS, MUSCLES, TENDONS

## CONDITIONS OF THE BONES, JOINTS, MUSCLES, TENDONS, ETC

**Painful Shoulder: Observations on the Role of the Tendon of the Long Head of the Biceps Brachii in Its Causation.** HAROLD H. HITCHCOCK and CHARLES O. BECHTOL. *J Bone Surg* 1948, 30-A 183.

Lesions affecting the tendon of the long head of the biceps brachii are among the more frequent causes of pain and disability in the region of the shoulder joint. In order to determine the incidence of supra-tubercular ridge and variations in the depth of the intertubercular groove, as well as their significance in producing lesions involving the biceps tendon 100 humeri were examined. The supratubercular ridge was found to be markedly developed in 89 per cent of the humeri and moderately developed in 5 per cent. Contrary to what is often superficially thought, it is not the tendon which slides in the groove but the humerus which moves on the fixed tendon during motions at the shoulder.

Dislocation of the tendon complete or incomplete may be differentiated from peritendinitis by the test of Abbott and Saunders. After full abduction of the shoulder the arm which is held in complete lateral rotation is slowly brought down to the side in the plane of the scapula. A palpable or even audible and sometimes painful click is noted as the biceps tendon now forced against the lesser tubercle becomes dislocated from the groove.

With a frozen, painful shoulder failure of the condition to clear up quickly with manipulation and physical therapy together with persistent tenderness over the intertubercular groove very probably means inflammation and adhesions about the biceps tendon. It should not be forgotten that peritendinitis of the long head may be associated with other lesions about the shoulder such as rupture of the tendon of the supraspinatus. In consequence the peritendinitis may be overlooked, with resultant disappointment in the results of therapy. Where recurrent or traumatic dislocation of the biceps is found surgery is indicated. The authors present 3 cases in which their operative findings were discussed.

Adhesions and peritendinitis of the biceps tendon are usually not seen until the tendon has been exposed by incision of the capsule and transverse humeral ligament the tendon may then be visualized from its origin as far as its point of disappearance beneath the tendon of the pectoralis major. After exposure of the tendon abduction of the arm will demonstrate whether the humerus slides freely along the tendon or whether it is bound by adhesions under the tendon of the pectoralis major. If such adhesions are present the terminal portion of the tendon will buckle with abduction. An S-shaped skin incision over the deltoid-pectoral interval serves to lessen the

tendency to hypertrophied scar which is common when a straight incision is employed. The tendon is roughened and is sutured beneath this osteoperiosteal flap with heavy silk sutures. The transverse humeral ligament is sewed down over the tendon and the osteoperiosteal flap. The portion of the tendon lying above the transverse humeral ligament is resected. The only residual disability is a slight loss in the power of abduction when the arm is in lateral rotation.

The authors indicate that in these cases of biceps peritendinitis in which the patients do not recover properly after conservative treatment, a much more rapid recovery with less economic loss can be offered by fastening the tendon into the groove. The results in 36 such cases were most satisfactory.

C. FRED GÖRINGER, M.D.

**Peritendinous Fibrosis of the Dorsum of the Hand.** ROBERT E. VAN DEMARK JOHN D. KOUCKY and FREDERICK J. FISCHER. *J Bone Surg.* 1948 30-A 184.

In contrast to the usual traumatic tenosynovitis which responds to treatment, a painful, persistent, peculiarly hard swelling localized over the dorsal metacarpal area and absent in the palm may follow a blow to the back of the hand.

The authors present the cases of a soldier who suffered from recurrent, disabling hard swelling on the dorsum of the hand following a severe initial blow. In each case, operative exploration and examination of pathological specimens revealed evidence of old and recent hemorrhage with fibrous-tissue proliferation and organization in the hemorrhagic area.

Infiltration of the extensor tendon by the fibrous tissue offers an explanation for the clinical finding of local pain and limitation of movement during flexion of the fingers. It is evident that with extremes of motion, further hemorrhage clotting fibroblastic organization and increased fibrosis occur deep to the superficial fascia. This explains the recurrent, localized and hard character of the swelling.

In such cases it would appear that the treatment of choice is early operative evacuation of the primary hematoma, and ligation of any bleeding vessels followed by a firm compression dressing. Involve organization of the adjacent hematoma cannot otherwise be avoided with certainty. In late cases evacuation of the hematoma should be followed by prolonged immobilization in order to allow maturation of the fibrous tissue and obliteration of the hematoma cavity.

It has become generally recognized that recurrence of swelling is common. The number of permanently cured cases is reported by Bettman as small. Iselin states that the edema persists indefinitely the



incapacity is often 60 to 75 per cent and the prognosis is very poor. A practical form of treatment is suggested by Watson Jones, who recommends prolonged immobilization in a dorsal plaster splint. This should be continued for several months after the swelling has subsided. C. FRED GÖRINGER, M.D.

### FRACTURES AND DISLOCATIONS

**The Results of Treatment of Congenital Dislocation of the Hip in Infancy.** FREDERICK C. BOST, M.D., M.C. EDWIN R. SCHOTTSTAEDT and LOREN J. LARSEN. *J. Bone Surg.* 1915, 30-A: 454.

The standards of Severin and Ponsetti were used in an evaluation of the anatomical and functional results of treatment in 112 cases of dysplasia and dislocation of the hip. The following method of treatment was used:

The abduction frame was used in 32 cases, traction on the Coonse modification of a Putti frame followed by manipulation was used in 13 cases, manipulation alone was used in 31 cases, remanipulation was used in 8 cases, multiple manipulations (more than three) in 3 cases, open reduction without shelf operation was performed in 21 cases, the shelf operation only in 2 cases and no treatment was given in 2 cases. The abduction bar proved very effective in infants under the age of 1½ years. No failures were encountered in effecting satisfactory reduction of the dislocated hip.

Excellent or nearly excellent anatomical results were obtained in 55.4 per cent and excellent functional results were obtained in 60.7 per cent of infants. Deterioration with age was not expected in this group. The best results were obtained with the least traumatic methods, such as the abduction frame and gentle manipulation preceded by traction. The gentler methods of reduction could be used in the youngest age group.

Treatment in infancy produced good anatomical results in 81.3 per cent of cases, and good functional results in 80.4 per cent. All of the patients in this group were less than 14 years of age when the ratings were made.

The development of the acetabulum progressed slowly, which indicated a probable need for longer periods of fixation after reduction of the hip. Delay in the reduction of dislocations caused increasing maldevelopment of the hip due, in part, to the thickening of the acetabular floor coincident with an increase in the co-ordinate.

Aseptic necrosis was observed in 53 per cent of the hips. It was present in only 12 per cent of hips treated by abduction but the incidence following traction and manipulation was 54 per cent and with manipulation alone 74 per cent.

An acetabular angle of 27½ degrees was selected as the upper limit of the normal acetabular index in infancy. In all but 2 patients treated within the first year of life the acetabular index dropped to within normal limits within a period of 18 months. In those patients treated during the second and

third years the descent of the acetabular index appeared more gradual than during the first year and in nearly one half of the patients never dropped as low as 27½ degrees. Only 6 patients in this group actually reached the acetabular index of the normal undislocated hip. VERNON C. TORREY, M.D.

**Results of Treatment of Irreducible Congenital Dislocation of the Hip by Arthrodesis.** CHARLES J. FAY. *J. Bone Surg.* 1915, 30-A: 411.

The author studied the cases of irreducible unilateral congenital dislocation of the hip treated at the Shriner's Hospital in St. Louis and at the University of Virginia Hospital and came to the conclusion that as compared with the results obtained by the shelf operation or by subtrochanteric osteotomy, arthrodesis offered the most consistently good end result from the standpoint of freedom from pain and satisfactory function. He felt that arthrodesis was especially to be recommended when the economic background was such that the patient would need to do heavy work for a living.

Fourteen patients were treated by arthrodesis, but only 8 had a adequate follow up study. The youngest child was 7 years of age, the oldest 15. Six patients were girls.

In each case an effort was made to reduce the hip by the shelf traction with from 30 to 70 pounds on the affected limb for from 3 to 8 weeks. Counter traction was obtained by extremely high elevation of the foot of the bed. When reduction was not obtained by this method arthrodesis was done in as good a position as could be obtained. Prior to traction no surgery shortening averaged 3½ inches after arthrodesis shortening averaged 7½ inches. In no case was there failure to fuse.

VERNON C. TORREY, M.D.

**The End Results of Early Treatment of Congenital Dislocation of the Hip, with an Inquiry into the Factors that Determine the Result.** A. B. GILL. *J. Bone Surg.* 1915, 30-A: 412.

One hundred and five patients were selected for study. Of these, 53 were treated by bloodless reduction only without subsequent operation. The perfect end-results are to be found only among those cases that are amenable to bloodless reduction.

If open operation is necessary for reduction, one can always observe the presence of one or more of those structural deformities that make the development of a perfect hip impossible. Of marked importance and frequency among these are the deformities of the neck of the femur (anteversion and shortening) and a high attachment of the capsule. Persistent aplasia of the acetabular roof is the most easily remedied of the anatomical defects. Aplasia of the femoral head erroneously called Legg Perthes disease can be observed in practically all cases. Gill believes that this defect is not due to trauma at the time of reduction. Inequality of the size of the acetabulum and head and capsular constrictions also prevent normal development of the hip. In about

6 per cent of the cases, such marked anatomical changes have taken place (absence of proximal femur etc.) that reduction is impossible.

In none of the 33 cases in which hips were operated on before 4 years of age because they were irreducible by manipulation, was a perfect end-result recorded. The author does not deny, but on the contrary strongly affirms that satisfactory and even perfect functional results may be obtained by operative procedures for the correction of the various deformities of the hip but even those with perfect function show some degree of anatomical imperfection.

Approximately 35 per cent of dislocated hips may be expected to become perfect or excellent after bloodless reduction if the reduction is accomplished before the age of 3 years. After 3 years there is a marked decrease in the percentage of successful reductions. However whether the reduction was done in infancy or in the third year seemed to make no difference in the statistics. The author believes that the end result depends upon the degree and importance of the anatomical changes about the hip and that these are not necessarily correlated with the age of the patient. However the normal relationship of the femoral head to the acetabulum may play an important part in the stimulation of the acetabular roof and other parts to normal growth. The congenital dysplasia is caused by a retardation or by an interruption or distortion of the normal growth process. From 15 to 30 per cent of hips may be expected to become functionally 'satisfactory' for a varying number of years, with the understanding that arthritic changes within the hip producing symptoms of fatigue pain and limp are prone to occur sooner or later.

VERNON C. TURNER, M.D.

#### Follow Up Study of the Early Treatment of Congenital Dislocation of the Hip. C. H. CHAGO JR., and J. R. SCHWARTZMANN *J Bone Surg* 1948 30-A 438.

This article is an analysis of the results of treatment of primary posterior dislocation and primary upward luxation, or subluxation, which occurred in 78 hips in 52 patients. The minimum follow up time was 1 year the maximum 15 years. In approximately 50 per cent of the total number of hips the follow-up study had been continued for 6 years or more. In 71 of the 78 hips dislocation was complete.

Skeletal or skin traction was used to bring the head of the femur into position opposite the acetabulum in all 71 cases. Although the position was obtained within 2 weeks traction was maintained for 4 weeks. Following this and usually with the use of an anesthetic, the head of the femur could be placed easily into the acetabulum by internal rotation and abduction of the thigh. This position was maintained by plaster for 3 months before further treatment was carried out. In no case were the authors unable to bring the head opposite the acetabulum by traction.

Anterior torsion of the femoral neck was found in 71 cases and since experience has shown that the

torsion does not correct itself supracondylar rotation osteotomy was done in 67 femurs. In 5 cases it was repeated because of incomplete correction of torsion by the first osteotomy. After 3 months of fixation in plaster following reduction a threaded wire was passed through the bone just above the osteotomy site then the knee and leg were rotated externally to neutral position without fear of disturbing the position of the hip. Further fixation in this position was maintained for 2 months to permit healing of the osteotomy.

In 25 cases open reduction was done when stable seating of the femoral head within the acetabulum could not be accomplished by manipulation. Operation was done to clear away the obstructing fold of capsule and the fatty tissue filling the acetabulum. In many instances the capsule and fatty tissue were eroded by pressure of the head so that after 3 months it became well seated without operation.

If fluoroscopic examination revealed that instability of reduction was due to a shallow socket an acetabular reconstruction was done. This consisted of levering the superior acetabular rim down over the femoral head and backing up the levered rim with cancellous bone chips from the ilium. This was done as an extra-articular procedure. A total of 40 such operations were performed, 3 being repeat procedures. Eight of 10 hips classified as presenting primary upward luxation required acetabular reconstruction. It is stated that the operation may be done satisfactorily at an early age (initial treatment).

The authors condemn forcible manipulation and prolonged fixation in plaster in the frog position. In none of the cases did aseptic necrosis of the femoral head comparable to the changes seen in Perthes disease develop. The authors were able to classify 26 hips (33 per cent) of the 78 as anatomically and functionally normal in this study 22 (28 per cent) were classified as nearly normal 24 (31 per cent) as satisfactory and 6 (8 per cent) as presenting failures.

VERNON C. TURNER, M.D.

#### Fractures of the Lower End of the Humerus in Children. D. P. McDONNELL and JOHN C. WILSON *J Bone Surg* 1948 30-A 347.

A series of 176 fractures of the lower end of the humerus in children was reviewed and 88 of these were followed long enough to draw some general conclusions with regard to treatment and complications. Of this latter group 55 were in boys and 33 were in girls. The ages of the patients ranged from 1 to 12 years the average age was 7. There were 53 supracondylar fractures 33 lateral condylar fractures 1 medial epicondylar fracture and 1 epiphyseal separation of the capitellum. A study of the end results in these fractures resulted in the following general conclusions.

Contrary to prevailing opinion, supracondylar fractures can produce serious growth disturbances if the fracture lines extend into the epiphyseal centers. Cubitus varus and cubitus valgus are not considered serious disabilities if flexion and extension are com-

plete. However if the deformity is progressive and is caused by disturbances in the growth centers disabilities and limitation of motion may occur years after the initial injury.

A satisfactory reduction is one in which the alignment in both planes is good. An anterior or posterior displacement of the fragments, in which the articular surfaces are displaced to a corresponding degree will produce permanent limitations of flexion and extension. Lateral displacement above the epiphyses will produce valgus and varus deformities but a good functional elbow may still result.

Supracondylar fractures in which the fracture line or part of it extends into the epiphyses may produce growth disturbances similar to those which result from fractures of the lateral and medial condyles. If the fragment is intra-articular and not attached to overlying bone and soft tissue it will undergo avascular necrosis. Supracondylar fractures of this type should have an accurate anatomical reduction and if the fragments are displaced and rotated an open reduction is probably the best method of obtaining accurate alignment.

A series of lateral condylar fractures in which there were poor results in 50 per cent of the patients treated by closed reduction speaks for the ineffectiveness of this method. Early open reduction with minimal trauma to soft tissues will give the best results. Avascular necrosis of the capitellum will occur if the fracture line separates the epiphysis from the overlying bone and soft tissues. Fractures of half of the capitellum occurred in 2 patients with lateral condylar fractures. One had poor apposition by open reduction, and avascular necrosis occurred in 1 year. In the other the separation was not complete the position was good and healing was uneventful.

Avascular necrosis of the trochlea may occur later despite good reduction of a supracondylar fracture. It can cause stiffness at the joint because of thinning of the cartilage and distortion of the articular surface of the humerus.

Delayed ulnar palsy may cause progressive growth disturbances, and was present in 2 cases of severe cubitus valgus deformity.

Fracture of the medial epicondyle will not cause a serious disability unless the fragment enters the joint cavity. Nonunion is difficult to avoid in closed reduction.

RODOLPH S. REICH, M.D.

**Early Operative Treatment of Fractures of the Tarsal Scaphoid** (Le traitement opératoire précoce des fractures du scaphoïde tarsien) J. FOU-LEUX and M. BONVALLET. *Rev. orthop.* Par 1948 34: 38.

These fractures may be classified schematically into the following types: (1) the type of fracture most frequently observed is transverse horizontal or slightly oblique downward and outward separating two fragments of variable size, the upper fragment is generally the largest and is luxated dorsally while the small lower fragment remains attached to the plantar ligaments; (2) the vertical

sagittal type; (3) multiple fractures with crushing of the bone and flattening in the anteroposterior direction; (4) without displacement.

The therapeutic indications vary with the type of fracture as illustrated by cases taken from the literature and 5 unpublished cases of the authors.

The outstanding fact revealed by study of the different cases is the frequency of unfavorable results following orthopedic treatment of these fractures. There are two main causes for poor results. The first of these is a disturbance in the statics of the foot produced by deformity of the scaphoid which normally constitutes the keystone of the internal arch. This deformity is due to lack of reduction of the original displacement by fracture, secondary reproduction of the displacement or the formation of pseudarthrosis after correct reduction and retention. Particular attention is called to the frequent occurrence of pseudarthrosis which explains the appearance of secondary deformities at the time walking is resumed despite roentgen evidence of satisfactory reduction. The second cause of poor results is astragaloscaphoid and cuneoscaphoid arthritis due to changes in the articular surfaces and tearing of the ligaments. It does not always appear with resumption of walking but several weeks, and sometimes months later. Therefore results declared as good after removal of the cast in orthopedic reduction should not be accepted as valid. These factors are important in fractures with luxation and crushing.

In fractures without displacement and in sagittal fractures which have been correctly reduced immobilization must be maintained for at least 3 months even then pseudarthrosis or arthritis may develop and require secondary arthrodesis. In old fractures arthrodesis after scaphoidectomy is indicated. In fractures with dorsal luxation and in crushing fractures which constitute the most important group the usual concept of treatment must be modified. The frequency of incoercibility of the fracture and of secondary reproduction of the displacement, the possibility of the occurrence of arthritis or pseudarthrosis despite correct reduction and immobilization justify consideration of immediate arthrodesis as the treatment of choice. This will save the patient suffering and repeated interventions. The authors favor scaphoidectomy with partial resection of the cuboid and mediotarsal arthrodesis a procedure which is not more complex than the English method of ankylosing the astragaloscaphoid and cuneoscaphoid joints by a dorsal tibial graft. It avoids taking the graft and has the advantage of removing the scaphoid, which is subject to pseudarthrosis and of solidly blocking the mediotarsal joint.

RICHAUD KEMEL, M.D.

**Marrow-Nailing of Recent Fractures, Pseudarthrosis and Bone Plastic.** ANDRÉS WESTERMARK. *A. n. Surg.* 943, 27: 577.

In 1944 the author described his first 28 cases of marrow nailing of fractures, and he now gives a report on 79 additional cases. Up until January 3, 1946

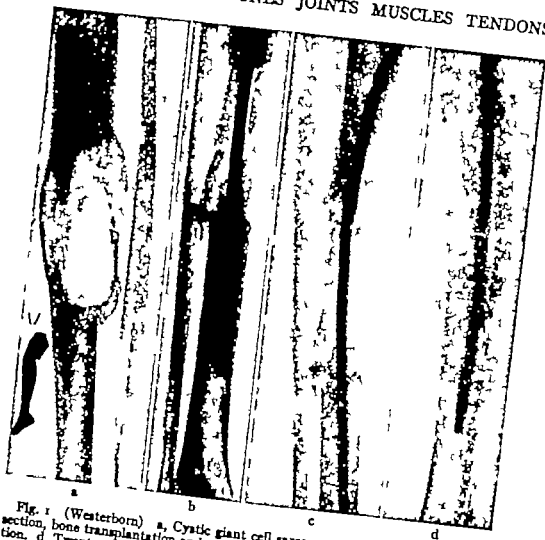


Fig. 1. (Westerborn) a. Cystic giant cell sarcoma of the tibia. b. After resection, bone transplantation and marrow nailing. c. Four months after operation. d. Twenty months after operation.

marrow nailing was used in 100 cases of which 69 had been recent fractures and 24 pseudarthrosis and in 7 cases plastic bone surgery was done.

The nail is inserted under fluoroscopic supervision or repeatedly checked by several roentgenograms. The author has made use of the latter method and found it satisfactory. The best results are obtained in the nailing of femoral fractures. The nail must be wide enough so that it establishes firm contact with the wall of the marrow cavity mainly in order to prevent rotation between the fragments. One can estimate from the size of the marrow cavity in the roentgenogram about what size nail to choose. The conditions are not so favorable in the tibia as they are in the femur because in the former the cavity is narrowest in the middle. Consequently it is easy to obtain firm fixation of fractures situated in about the middle of the tibia but not of those situated more distally or proximally. If full stability is not obtained with one nail it is wise to insert another one. This needs to be done more often in cases of bones with uneven medullary cavities such as the tibia and humerus than of bones with an even canal.

The advantages of medullary nailing are (1) a shortened stay in bed (2) simplified after treatment —no extension (3) less pain and other subjective

trouble (4) less risk of stiff joints muscular atrophy and circulatory disorder and (5) shorter hospitalization and earlier acquirement of working capacity. Marrow nailing involves the danger of bone marrow destruction, fat embolism, and osteomyelitis but experience has shown that the damage that the nail causes to the bone marrow is of little or no practical significance. It is recommended that the nail be removed when full consolidation is established. After a few months the nail generally lies fairly loosely in the marrow cavity. Extended osteomyelitis generally does not develop but only restricted osteitis with local sequestration mainly because of the fact that the pus in the marrow cavity is led off along the nail. According to Kuentscher, Boehler, and others there is never any enclosure of pus with rising pressure in the cavity which pus formation is generally considered to be the cause of. Kuentscher says that when pus is easily removed but the nail should not be removed since the fracture generally heals in spite of the infection.

The author has made use of medullary nailing in 24 cases of pseudarthrosis. The bone healing was satisfactory in all except 3 cases in which inflamma-

tion recurred after operation. A report of the results in 18 cases in Kirschner's clinic indicated that bone healing took place in 15 cases within 6 to 8 months after marrow nailing. In order to hasten the bone healing the marrow nailing may be combined with other operations such as bone transplantation either in the form of bone chips according to Levan der or by covering the pseudarthrosis with a larger bone piece. Often marrow nailing alone is sufficient.

In 6 cases of pseudarthrosis of the thigh bone which persisted from 1 1/2 to 3 years in spite of attempts with many different methods, it was not possible to obtain osseous healing. In 3 of the cases persisting fistulas with a slight discharge were present at the time of operation. In one case the fistula healed soon after the operation. In the other there was still slight suppuration at the time the patient was discharged. In order to avoid the risk of reactivation of a latent infection, sulfathiazole was introduced into the operative wound in all of the cases. In 3 of the 6 cases, consolidation had taken place before the patient was discharged. In the other 3 there were indications that osseous healing would take place shortly.

The new method is vastly superior to the old ones for treatment of femoral pseudarthrosis. The post operative treatment is very simple. After 1 or 2 weeks in bed the patient is allowed to get up. The prolonged stay in bed before the operation produces more or less marked stiffness in the joints as well as muscular atrophy which necessitates intensive physical therapy. The most important condition for osseous healing is absolutely firm fixation of the fragments. C. F. ED GOERINGER, M.D.

## ORTHOPEDICS IN GENERAL

**The Serious Limitations and Erroneous Indication of Biopsy in the Diagnosis of Tumors of Bone**  
JAMES I. BRADFORD, FRANK R. SEC. M. LOND  
945, 4 5

The author engages in an interesting and rather convincing discussion concerning the diagnosis of bone tumors particularly as to whether they are benign or malignant. Attempts at classification based on the histological appearance are of academic rather than of practical importance as they tend toward erroneous interpretations. Certain simple lesions, which resolve completely when undisturbed present histological appearances liable to be interpreted as evidence of malignancy, yet this evidence cannot be obtained without biopsy or more extensive surgery. This cannot be done without causing the patient mental and physical pain or without subjecting the patient to the risks of an anesthetic, complications and the possibility of erroneous interpretations.

The simple lesions have characteristic roentgenographic appearances which can be verified by serial roentgenography without causing pain or subjecting the patient to any risks. Fortunately the diagnosis of bone tumors can be checked by clinical observation and serial roentgenography.

Since amputation at the earliest possible moment does not ensure cure of a malignant tumor and since we have no means of telling whether metastasis has occurred, there is little to be gained by precipitate amputation but much to be gained by clinical and roentgenographic study.

The author takes issue with the attitude of the orthopedic surgeons who prefer to think that the diagnosis of bone tumors is in the province of the surgeon who is called upon to explore the tumor in order to biopsied tissue for biopsy studies. It is well known that apparently inoperable lesions may resolve completely. Meddlesome interference often incurs the usual delays resolution and may prevent complete restitution. Roentgenography on the other hand does not inflict pain or risk on the patient. Serial roentgenographic studies of all bone lesions reveal details without causing a patient the patient. Such studies permit of more accurate diagnosis and a better treatment of the patient.

If the roentgenographic appearance can be elucidated by inflammation of bony or other disorders it would be reasonable to give a course of appropriate medication in any doubtful case and, if this failed to produce a favorable response a course of deep x-ray in therapy.

Very questions are presented to the reader by the author with appropriate answers. One is convincingly impressed with the more conservative trend and the emphasis which is placed on roentgenology rather than surgery or biopsy studies in the evaluation of bone tumor cases.

Osseous hematomas not only in scurvy and osteogenesis imperfecta but also in limbs with neurovascular disturbances and in hemophilia, and even at the site of suspected fractures, have been mistaken on their clinical and histological evidence as sarcoma and amputation was done when the patients were considered fit enough to stand the operation. Undoubtedly some of these cases have been regarded as cures by amputation. Although roentgenographs taken of the lungs or skeleton (metastases from osteogenic sarcoma often develop in other parts of the skeleton before they are recognizable) the lungs (the latter being a minimal event) may fail to reveal any evidence of metastases, thus is no proof that they do not exist. The author makes it a rule to regard any lesion a simple in the first instance if there is definite evidence of trauma and the roentgenographic evidence is such as could have been produced by trauma. Bone lesions with a history of recent trauma and roentgenographic evidence of changes which could have been produced by trauma should be treated with medications, as inflammation notwithstanding certain roentgenographic features which may arouse the suspicion of malignancy.

Remarkable response of carcinomatous metastases from some primary lesions in the breast or prostate to stilbestrol within a few weeks furnishes hope that some such hormone will be found to cure sarcoma. C. FRED GOERINGER, M.D.

**Bone Changes in the Cat in Experimentally Produced Injury to the Peripheral Nerves.** MAURICE A. SCHILLER. *J Bone Surg* 1948, 30A 469

The history of the development of our concept of the causes of post traumatic bone atrophy is described. This article attempts to throw some light on the argument as to whether the bone atrophy is of organic origin or hysterical.

The author has studied by means of roentgenograms, the bones of the extremities of cats on each of which section of the sciatic nerve had been done 4 cm. below the sciatic notch. Roentgenograms were obtained of the animals 30, 60, 90, 150 or 180 days after the operation. Apparently one set of roentgenograms was obtained of each animal.

In 11 of 18 cases in which the nerve had been sectioned, followed by primary suture and a cast to the extremity ulcers developed and in 5 of these there was x ray evidence of bone atrophy. In only 1 of 11 patients in whom no cast was used but in whom ulcers developed bone atrophy was found. In 27 patients in whom no cast was used and ulcers did not develop there was no evidence of any bone change.

The author concludes that atrophy of bone does not result from denervation of an extremity nor from immobilization of denervated extremities but that it occurs as a result of ulceration overlying the bone and joint. VERNON C. TURNER, M.D.

**Contractures following Experimentally Produced Peripheral Nerve Lesions.** IRVING C. SHERMAN. *J Bone Surg* 1948, 30A 474.

The author reports the following methods by which contractures develop following peripheral nerve injuries.

1. There may be adaptive shortening of an active innervated muscle because of the lack of opposition of the paralyzed antagonist. This is called a myostatic contracture.
2. An active contracture may develop in muscles when the motor nerve is irritated or compressed.
3. Neurogenic protective contractures may follow peripheral neuritis.
4. Sympathetic nervous system disturbance following mild trauma and associated with traumatic vasomotor and thermic changes in the extremity also produce contractures similar to those seen in rheumatoid arthritis.
5. Fascial shrinkage will produce contracture as exemplified by Dupuytren's contracture of the hand.
6. "Set" contractures gradually develop after from 6 to 8 weeks of immobilization combined with denervation of a muscle as in poliomyelitis.
7. Contractures may result after splinting an extremity because of hysteria or habit.

The author studied the contractures of the main muscles of the extremities of cats in which denervation was accomplished by sectioning the sciatic nerve 4 cm. below the sciatic notch. Some of the animals were subjected to primary suture of the nerve others to delayed suture and some to immobilization of

the extremity in casts following denervation. The contractures were measured as to the degree of limitation of motion with and without anesthesia. Finally the animal was sacrificed and the tendons were cut to be sure that the limitation of motion was due to muscle shortening rather than capsular or joint changes.

The author found that contractures developed in 100 per cent of the denervated muscles maintained in a shortened position by casts for from 45 to 105 days. On microscopic examination of the muscle there was found to be excessive fibrous tissue. Contractures developed in 84 per cent of the animals following primary suture and in 100 per cent following delayed suture after 90 days. The contractures were less severe less frequent, and less persistent after primary suture than after delayed suture in untreated animals. The longer the difference in time between the recovery of the opposing muscles, the more likely was the development of contracture in the muscle which recovered first.

If electrotherapy was used there was a delay in the appearance of the contractures but if it was used for a long period the frequency and severity approximated those in the untreated animals. Electrotherapy favors the development of contractures in the unparalyzed antagonists of paralyzed muscles. Electrotherapy is therefore favorable in the early treatment of paralysis but not in the late treatment.

Since the frequency and severity of contractures were greater after delayed than after immediate suture one is justified in urging early operation after severance of a peripheral nerve.

VERNON C. TURNER, M.D.

**Congenital Absence of the Humeral Head.** A. T. ANDERSEN. *J Bone Surg*, 1948, 30B 333.

The author reports 2 cases of unrecognized congenital absence of the humeral head. Only 6 cases with a similar roentgenographic appearance could be collected from the literature. Experimental data suggests that the time in development at which the fault occurred was probably the joint stage just when the articular rudiments had separated.

The essential features are complete or incomplete absence of the humeral head with a rudimentary glenoid fossa. The deformity may be unilateral or bilateral. It may be isolated or one of a number of deformities in the same patient. There is relatively slight disability. The humerus is short and abduction movement of the shoulder is limited.

DANIEL H. LEVINTHAL, M.D.

**Function of the Cruciate Ligaments of the Knee Joint.** A. J. HELPER. *Lancet* Lond. 1948, 1 665.

The author questions the generally accepted thesis that the cruciate ligaments control the anteroposterior stability of the knee joint. Through anatomical and clinical study he deduces that the cruciate ligaments serve as guide ropes during rotation at the knee joint. Since the medial collateral ligament is fan-shaped and part of the fan is taut in

every position of the knee joint the finding of anteroposterior laxity is probably due in part if not chiefly to the rupture or weakness of this ligament.

The author's observations indicate that the tibia rotates laterally on the femur in the last 30 to 40 degrees of extension; conversely it rotates medially during the last portion of flexion. The anterior cruciate ligament remains at constant tension during extension and the posterior cruciate acts similarly in flexion.

If the tibia is prevented from lateral rotation during extension, the anterior cruciate ligament is seen to be stretched tightly over the lateral border of the medial femoral condyle. This may be observed at operation if a dislocated meniscus, or rotation may be prevented manually at operative or laboratory examination. This may be the source of medial femoral condyle erosion noted frequently at operation for a medial meniscus.

In bucket handle tears of the medial meniscus, the lateral rotation of the tibia on knee extension is prevented. Thus at full tension the anterior cruciate ligament must be torn at the time of injury.

gradually stretched during convalescence when full extension is acquired. The fact that lateral rotation is prevented during extension in this type of

meniscus tear serves as a clinical test in diagnosing knee injuries. Although extension may not be complete in effusion or injuries to the fat pad, lateral rotation takes place.

The author notes that anteroposterior laxity of the knee joint in ligamentous injury is almost always associated with tears of the medial collateral and the anterior cruciate ligaments.

With the hypothesis that much of the sensation of weakness and instability of the knee joint with relaxations of the ligaments comes from loss of control of rotation, the author suggests certain tendon transplantations to insure lateral rotation of the tibia during extension and medial rotation on flexion.

He advises medial transplantation of the patellar tendon insertion to a first lateral rotation of the tibia, and transplantation of the course of the semitendinosus tendon into a groove in the medial femoral condyle to facilitate active medial rotation during flexion.

A report of 7 cases of anteroposterior instability of the knee with satisfactory results is given. The patients have fairly good knee control and stability on walking up and down stairs and on rough ground. At rest the abnormal movement is present as prior to operation.

KENNETH H. SPENCER, M.D.

# SURGERY OF THE BLOOD AND LYMPH SYSTEMS

## BLOOD VESSELS

**Surgery in Peripheral Vascular Disease.** HARRIS B. SHUMAKER. *Surg. Clin. N. America*, 1948, 28, 294.

In the present communication it is the author's purpose to discuss general principles in the treatment of peripheral vascular disease and the application of some of the commonly used surgical measures. He makes no effort to present the detailed management of patients suffering from these disorders nor to consider all the operative procedures of value. The author hopes that this approach will not convey the impression that he holds lightly the importance of the most minute attention to details in prevention, diagnosis and treatment of the peripheral vascular disorders.

It must be recognized that certain limitations exist in the prevention and treatment of peripheral vascular diseases and injuries. In the first place at the present time very little or nothing concerning the precise etiology of most of these disorders is known therefore prevention is impossible. Another limitation which must be recognized is the fact that, in general the vascular disorders are associated with irreparable changes. A third limitation in treatment concerns the common delay in seeking medical advice. Many of the chronic vascular disorders have an insidious onset and as a general rule patients fail to appreciate the significance of the initial complaints. These limitations just mentioned pertain to the disease processes and to the individuals who suffer from them. There are also unfortunately, certain limitations which arise as a direct failing of the medical profession. The first concerns a too widespread lack of understanding of the method of obtaining a vascular history and of performing a vascular examination, and a corresponding lack of diagnostic training in medical schools and in postgraduate education. An occasional related failing of the medical profession concerns a lack of appreciation of the gravity of the situation imposed by significant reduction in blood supply.

The author discusses some of the common surgical operations which are applicable. Sympathectomy, crushing of sensory nerves, amputation plastic procedures and arterial embolectomy are discussed. In summary the fundamental principles underlying the treatment of peripheral vascular disorders have been discussed and the basis for certain of the commonly applied operative procedures has been presented. It is believed that surgery has much to offer in the treatment of these harassing difficulties provided that the limitations are recognized that the procedures are utilized upon reasonable indications and are both skillfully performed and supplemented by proved nonoperative aids.

HERBERT F. THURSTON, M.D.

**Portacaval Anastomosis—Observations on Technique and Postoperative Care.** ARTHUR H. BLANK, MORE. *Surg. Clin. N. America* 1948 28 279

The author notes that clinicians familiar with the natural history of Laennec's cirrhosis of the liver are well aware of the role of portal hypertension in that disease. In an analysis of 386 cases of portal cirrhosis of the liver Ratnoff and Patek noted rupture of esophageal varices as the cause of death in 26 per cent of the cases.

Cirrhosis of the liver secondary to hepatitis is a not uncommon cause of portal hypertension and bleeding from esophageal varices. Banti's syndrome with esophageal varices secondary to portal hypertension invariably leads to death, sooner or later from hemorrhage. Schistosomiasis of the liver that has developed to the point of causing esophageal varices as the result of portal obstruction almost invariably causes death eventually from hematemesis. Finally in 2 cases of the present series, repeated hematemesis resulted from portal vein obstruction secondary to pancreatitis. The above conditions are considered the common causes of portal hypertension.

When one considers that portal hypertension is one common factor that is responsible for dire consequences it is not surprising that the subject has received considerable thought in the past. In fact, ever since Von Eck in 1877 anastomosed the portal vein to the vena cava in dogs surgeons have accepted the rationale of portacaval shunt for the amelioration of portal hypertension. Though the rationale of the procedure was early accepted many years were required to forge those advances in surgery so essential to its clinical success.

A method of establishing portacaval shunts to be clinically acceptable must meet two important requirements (1) a high chance of survival for the patient (2) a high likelihood of maintained patency of the anastomosis.

The author notes that to date portacaval anastomoses have been accomplished forty times with a postoperative mortality of 25 per cent. Success of the portacaval shunt procedure depends primarily upon the selection of cases for operation careful attention to technical details, and upon preoperative and postoperative handling.

The most serious handicap in the beginning was inadequate knowledge upon which to base an intelligent evaluation of the relative operative risk in a given case. This was particularly true when dealing with cases of cirrhosis of the liver and accounted for 5 of the postoperative deaths.

The onus of infection must always be kept foremost in mind. The subtlety with which a so-called low grade green streptococcus can wreck by thrombosis an otherwise perfect anastomosis should be a caution to all. In the course of a year following the



Introduction of the electrothermic method for the treatment of aneurysms at the Presbyterian Hospital New York the following routine was established for the prevention of infection (1) rigid asepsis on the part of the operating team regarding the wearing of helmets, masks, scrubbing, and otherwise scrupulous individual precautions, (2) skin preparation by a soap and water scrub followed by alcohol ether iodine and alcohol (3) meticulous covering of the skin edge as follows make the skin incision ligate superficial blood vessels with fine silk, cover the skin edge with towels held in place by closely spaced Michel clips reinforced with a towel slip at either end of the wound discard all used instruments and change the gloves before proceeding with the operation (4) the prevention of air borne infection by a bacteriologically controlled system of ultraviolet lights (5) a pleasant but not essential addition to the foregoing regimen for the operating room is air conditioning.

Before the institution of this outlined regimen for the prevention of infection a total of 3 patients with a red aneurysm became infected all of whom succumbed. After the institution of the combined regimen some 300 wiring operations for aneurysm were performed at the Presbyterian Hospital over a 10 year period without a single infection. Recent experience has shown that penicillin even in large doses cannot be depended upon to prevent infection in cases of aneurysm undergoing the wiring operation. In 2 cases in which penicillin was given in 100,000 unit doses before wiring and for 14 days after operation at 3 hour intervals infection developed in the aneurysm in each case. A *Streptococcus viridans* organism was recovered from both. The only other variation of routine in these operations was the omission of ultraviolet radiation. The above citation is made not to discourage the use of penicillin but to illustrate that there are bacteria resistant to its action and the failure to use ultraviolet radiation in these 2 cases has the appearance of a serious omission which shall not be repeated in the future.

In regard to the suture versus nonsuture method, the author notes that there is not yet conclusive proof that the suture method is superior. The score in 3 proved cases is nonsuture anastomosis closed 3 cases suture anastomosis closed 1 case. All were splenorenal anastomoses. The nonsuture method however does have the advantage of conserving the kidney in the splenorenal type of portacaval shunt.

The author discusses factors which stem basically from the hemodynamics of the venous system which in general when compared to the arterial system, are unfavorable for the continued patency of anastomoses. According to the author the following measures should be taken in portacaval anastomosis: (1) the avoidance of twisting of the anastomosed veins or angulation upon repositioning of the viscera (2) measures to maintain the blood pressure at satisfactory levels from the time the anastomosis is opened until it is healed (3) measures to prevent

abdominal distention (4) avoidance of early ambulation and (5) anticoagulant therapy. The accuracy of blood clotting time determinations is, of course the first prerequisite to safe heparinization in these cases.

A great deal of unnecessary confusion and blood loss may be eliminated at the time of opening the anastomosis if the surgeon has properly and carefully ligated with transfixion ligatures all venous branches in mobilizing the splenic vein before starting the anastomosis. Usually a 4 cm. to 5 cm. segment of splenic vein is adequate. Extreme care must be taken in accurate placement of the first anastomosis sutures to prevent twisting of the splenic vein. Any significant angulation of the splenic vein should disappear upon replacement of the kidney in its normal position posteriorly. In summary the author has reviewed some of the common causes of portal hypertension. The rationale of the portacaval shunt for the control of gastrointestinal hemorrhage due to portal hypertension is discussed. Factors having a bearing upon the operative risk and success of the portacaval shunt procedure are emphasized. Points in technique are discussed.

HENRY F. TUCKERSON, M.D.

#### Arterial Anastomosis in War Wound of the Extremities. WILLIAM F. MACFEE, Surg. Gen. U.S. Army, 918 25 351

War wounds involving the peripheral arteries are among the most distressing encountered, for they may appear to be limited in extent and yet become disastrous in consequence. The total incidence of arterial injuries in the armed forces of the United States in World War II was 0.6 per cent, and in wounds of the extremities 1.4 per cent. Usually the casualty has multiple wounds and there is widespread destruction of soft tissue which precludes simple suture repair of the vessel.

Rose, Hess, and Welch demonstrated that the arteries of greatest surgical importance in war wounds are the axillary, brachial, femoral, and popliteal. The principal injuries found in these arteries are spasm, contusion, complete and incomplete lacerations, traumatic aneurysms, and arteriovenous fistula. The definitive treatment of the last two is delayed weeks to months and need not concern the forward hospital.

Sympathetic block with procaine was the procedure most often used for arterial spasm. Results were sometimes good but not consistently so, and it is probable that the method could not be given a fair trial under combat conditions. Arterial contusion results in thrombosis if the intima is broken, and in late secondary hemorrhage with hematoma formation and its complications if the arterial wall is sufficiently damaged. Embolectomy is less helpful than might be thought for the procedure is useless without anticoagulants, and these agents are almost impossible to use in the forward area. The immediate danger from incomplete laceration is fatal hemorrhage. It is the wound which if seen

early, is most favorable for simple suture repair. If seen late when thrombosis has occurred in the distal arterial tree a satisfactory outcome may be hoped for. Completely severed arteries can be treated adequately in most cases only by some method of bridging the gap for there is wide retraction of the cut ends, destruction of collateral vessels, and loss of soft tissues with a segment of the major vessel. Blakemore and his associates using a vein graft with vitallium tubes or cuffs believed that a basis for success for this type of anastomosis was established for the first time, for infection and thrombosis could be controlled with anticoagulants sulfonamides and penicillin. The total reported experience of several authors is thought to be insufficient to warrant a clear appraisal of its worth yet it seems to be a step in the right direction. Glass and plastic (alkathene) tubes with and without vein grafts were also utilized for this type of injury.

Tables are given of the results reported by several authors, of these various methods of restoration of the injured vessel. A comparison is also furnished of the end results obtained by all methods of treatment without regard for the author. These results need not be reported in detail, for the wide discrepancies between the results obtained by different authors make interpretation extremely difficult, and indicate the many variables present in a problem of this nature.

It is obvious that a satisfactory method of restoring the function of an artery severed by a high velocity missile is yet to be developed. The prepared vein graft of Blakemore the use of anticoagulant and the antibiotic preparations are partial answers to the problem. It may be that the inevitable conditions of warfare may be more responsible for the failures than the methods employed.

ALLAN D. CALLOW M.D.

**Fourteen Attempts at Arterial Thrombectomy Following the Method of Jean Cld dos Santos.** *Doobstruent Thromboendarteriectomie (Quatre cas de thromboendarteriectomie artérielle suivant la méthode de Jean Cld dos Santos. Thromboendarteriectomie doobstruante). René LERICHE. Mém. Acad. chir., Par., 1948, 74 100*

The author describes his experience in 14 attempts at thrombectomy for arterial thrombosis. With the technique described by dos Santos a line of cleavage is established between the media and inner elastic lamina so that the arterial intima is removed with the thrombus. At times a good part of the media is also removed with the clot. When the arterial lumen has been cleared the blood flow is restored through a tube in which there is no endothelium. Heparin is administered routinely but even when the period of heparinization was limited (by hemorrhage) to 45 hours there was no clotting. The operation requires exposure of the full length of the thrombosed artery in order that hemostatic forceps may be placed above and below the throm-

bus as well as on all the patent branches. Originally following dos Santos the author and his assistant attempted to ream out the thrombus and the adherent endothelium with a bistoury starting from either end. They now use the technique of Reboul in which the artery is incised its full length. After the thrombectomy has been completed the artery is reconstructed with a continuous lock stitch of fine silk. Before the clamps are released the artery is filled with serum in order to detect leaks and drive out the air. Heparin is injected into the artery at the end of the operation and heparinization is continued during the post operative period. In 3 cases severe hemorrhage was attributed to heparin it was fatal in 1 of them. In the 14 attempts 7 operations were completed as planned. One patient died of hemorrhage with a permeable artery. Three patients had excellent results and 2 had recurrence of the thrombosis. The author does not give the result in the seventh case.

Because of the uncertainty of the operation it is suggested that lumbar sympathectomy should also be performed but at an earlier time because of the danger of hemorrhage when heparin is used to safeguard the patency of the thrombectomized artery. THORODRE B. MARSHALL, M.D.

**So-called Syndrome of Arterial Embolism and Acute Ischemia of the Extremities (Syndrome dit d'embolie artérielle et d'ischémie aiguë des membres).** MARC LERLIER and HIZIM DE BALBAC. *Mém. Acad. chir., Par., 1948 74 227*

The authors state that the classical concepts regarding aseptic embolism of the extremities do not explain all the facts found and published by many surgeons but a study of 9 personal cases has allowed them to elaborate a totally different theory. These 9 cases presented a nearly identical symptomatology but differed greatly in operative and autopsy findings. This puzzled the authors until they decided to abandon the embolic hypothesis and to accept arrest of the arterial pulsations as the initial primary phenomenon, and the formation of clots as second ary with the time of its appearance depending on the condition of the patient. This postulate explained everything.

Because a clot was found in the artery in some cases after an ischemic syndrome the classical conclusion although that the clot arrived there by migration of cases. However it is more in accord with clinical observation and more fruitful in therapeutic conclusions to separate the known facts from guesses at the mode of appearance. The incontrovertible facts are the following: (1) a characteristic clinical syndrome consisting of severe pain, stupor of the extremity signs of gangrene progressing rapidly and absence of pulsations and oscillations and (2) variable anatomic or operative findings: the artery may be obstructed or free its walls altered or intact, and the neighboring veins normal or thrombosed, and the it is appropriate to describe simply an anatomoclinical syndrome of acute ischemia of the extremities of

variable etiology including arteritis (pseudembolic form of chronic arteritis), spasm, embolism, phlebitis and even traumatism. Whatever the origin may be the course to follow is the same.

Medical treatment: emergency administration of heparin and then of dicumarol, the latter under laboratory control. At the same time treatment of the spasm with papaverine given intravenously and slowly (from 0.06 to 0.20 gm. in the first 2 hours) and by novocain infiltration of the sympathetic. A period of 24 hours seems to be long enough to determine whether the treatment will succeed or fail.

Operative indications: if the patient is in an alarming condition with circulatory failure operation is useless. If he is in good condition the lesion being only local, the decision to operate must be based exclusively on the persistence of pain and the signs of clinical ischemia.

Choice of operative method after exposure of the artery under local anesthesia, the following conditions may be encountered and the intervention will vary accordingly: (a) Venous thrombosis separation of the artery from the vein and, if the arterial pulsations return, phlebotomy only. (b) Hard and thin thrombosed artery with periarteritis: arteriotomy to seal the collateral route. (c) Small spasmotic, hard and probably thrombosed artery: arteriotomy to remove the clot. If blood continues to dribble, milking of the artery as high as possible. If this is unsuccessful in production of an oiled sound to verify the absence of an obstacle. (d) Doubtful case: Leriche resect the artery when the endothelium seen through the arteriotomy wound is altered. When speed is indicated by the patient's condition when suture is made difficult by the local conditions, when the thrombus recurs immediately after suture and when there is an embolism from an infected endocarditis.

Periarterial sympathectomy should be added if it will not complicate the intervention. It is advisable to inject heparin directly into the artery before closing it. In general, if the pulsations return the prognosis is good. If they do not, the prognosis is poor and all possible measures must be utilized.

Of the 9 patients operated upon, 4 survived and 5 died.

RICHARD KEMEL, M.D.

## BLOOD TRANSFUSION

The Influence of Electric Shock and Adrenaline Injection on Leucopoiesis and Erythropoiesis.  
H. M. MORTIMER. *Brit med J* 1947 1: 29, Supp. 20.

The purpose of this investigation was (1) to find out whether severe irritation of the central nervous system by electric shock influences hematopoiesis, and (2) to study the effect of adrenaline injection on leucopoiesis and erythropoiesis.

There were no consistent effects of electric shock on the blood picture, but the bone marrow revealed a slight increase in the ratio of myeloblasts, promyelocytes and myelocytes to granulocyte forms. After a adrenal injection the increase in mature granulocytes and lymphocytes seemed to originate in the blood-forming organs.

These observations do not prove the existence of a neurogenic regulation of hematopoiesis, but the author believes that "they give a certain technical support to the assumption that it already occurs in physiological conditions."

There is a complete discussion of the literature on this subject with a bibliography of more than 400 references. The monograph should be of considerable interest to investigators in this field.

H. W. and L. ALZ, M.D.

# SURGICAL TECHNIQUE

## OPERATIVE SURGERY AND TECHNIQUE POSTOPERATIVE TREATMENT

**Amiotomic Amputations (Amputações amiotómicas)**  
F. PAES DE VASCONCELOS. *Arg. Med.* 1947 19 66.

Because there is no satisfactory technique of amputation for the root of the extremities in serious cases the author proposes a new method which (1) causes little shock (2) eliminates all elements which may maintain or favor the progress of the morbid factor (3) assures good exposure of the infected parts when the amputation stump must remain open, avoids secondary contamination of the noninfected parts and allows easy secondary suture of the wound (4) assures the functional value of the stump, and (5) facilitates a higher type of amputation by extending the incisions, thus complying with the therapeutic indications found during operation.

To fulfill these requirements the author obeys the following rules. He does not section the muscular mass the muscle is completely extirpated or is left entirely in the stump in accordance with the amiotomic rule. He makes the cutaneous incisions so as to outline two flaps which come together over the sites of the vessels and of the muscles which are more deeply inserted. Thus, prolongation of the incisions allows a higher type of amputation improves drainage and exposure and above all facilitates the maneuver of detaching the insertion of muscles. On the other hand, the cutaneous flaps form two valves one contains the muscle which was entirely left behind, is attached to the flap by aponeurotic expansions and will cover the bone stump with its tendinous portion thus avoiding exposure of the bone stump and insuring easy secondary suture when the amputation stump must remain open the other valve covers a large and amply exposed space corresponding to the vessels and the removed muscles through which infection could spread more easily and dangerously.

The author refers to the general principles of the technique and classifies the cases in which it is indicated. He describes in detail the technique of amputation for the root of the upper extremity which he calls subdeltoid amiotomic amputation, and for the root of the lower extremity which he calls 'infratrochanteric amiotomic amputation. He reports his cases and shows how to perform atypical amputations in accordance with the amiotomic technique.

RICHARD KERR, M.D.

## ANTISEPTIC SURGERY; TREATMENT OF WOUNDS AND INFECTIONS

**Ulceroglandular Tularemia Treated with Streptomycin** RAYMOND E. LESSER and SMOLEY MILLER.  
*N. England J. M.*, 1948 238 554.

The authors report 2 cases of ulceroglandular tularemia in which they noted the efficacy of strepto-

mycin therapy in the chronic phase of the disease. The effectiveness of streptomycin treatment in these cases parallels that which has appeared in the literature to date. The second case was of particular interest since it illustrated the clinical course of a 26 year old paratrooper who was hospitalized some 3 months after the origin of the disease.

During the hospital stay the patient was afebrile. With the establishment of the diagnosis of tularemia, streptomycin therapy consisting of 0.2 gm every 4 hours for a total of 4.4 gm over a 4-day period was instituted. During treatment there was beginning regression of the lymphadenopathy and diminution of the weakness. One week later all tenderness of the lymph nodes had subsided but slight residual adenopathy remained. After discharge the man was seen periodically as an outpatient. Objective and subjective improvement continued with complete resolution of the adenopathy and with ability to carry on with military performances. Except for weakness and nausea following exertion the patient remained well until about 9 months after the streptomycin therapy when he experienced a mild aching sensation in the left thigh left leg and left lower quadrant.

Some 11 months after his first hospital admission the patient was readmitted to the hospital. Because of the rise in the agglutination titer as well as the significant change in clinical course it was believed that he was experiencing a relapse. Therefore streptomycin was started consisting of 3 gm daily for 7 days in divided doses or a total of 21 gm. At the conclusion of therapy the patient felt markedly improved, and the adenopathy slowly regressed. Previously, he had lost 15 pounds in weight. One month after therapy he had regained 7 pounds.

Although the clinical response to streptomycin was definite the subsequent course of the disease indicates probable inadequacy of dosage initially. It may also indicate decreased effectiveness of treatment when a delay occurs between the initial phase of the disease and the institution of therapy. The inability of streptomycin to effect lasting remission in Case 2 was probably due not only to this fact but also to the development of resistance by the organism to the antibiotic agent. The initial amount of streptomycin used may be considered inadequate in the light of current knowledge of organism sensitivity.

C. FRED GOSWAMY, M.D.

## ANESTHESIA

**The Use of Prolonged Continuous Spinal Anesthesia to Relieve Vasospasm and Pain in Peripheral Embolism.** SCOTT M. SMITH and VINCENT L. REED. *Anesthesiology* 1948, 9 329.

The value of interrupting the sympathetic impulses to peripheral vessels in cases of embolism has

been well established. In the lower extremities it may be accomplished by the administration of spinal anesthesia. This will provide immediate relief of pain and vasospasm and allow one to evaluate the circulation. Procaine is probably the agent of choice and is perhaps best used in a 1 per cent solution.

Prolonged continuous spinal anesthesia has been used in the management of 3 cases of peripheral embolism. In 3 other patients single injection spinal anesthesia was employed for the relief of pain and vasospasm.

No neurologic changes were noted in any of the cases in which prolonged continuous spinal anesthesia was employed. It was noticed, however that despite the agent used the relative duration and effectiveness of the anesthetic agent became progressively less and in 2 of the 3 cases two agents were used to prolong the anesthesia to 60 hours and 43 minutes and 43 hours respectively. A total of 4.45 mgm. of procaine was used in 1 case over a 44 hour period.

Single injection anesthesia and prolonged continuous spinal anesthesia are valuable aids in the treatment of peripheral embolism. In some instances, surgical removal of the embolus may not be necessary when adequate block of the sympathetic nerves to the involved extremity is maintained. Surgical intervention should not be delayed when there is questionable improvement following the sympathetic block. The use of cooling by any method should be avoided. Delay and procrastination have no place in the treatment of peripheral embolism.

MARY FRANCES FOX, M.D.

**Combined Anesthesia for Cesarean Section (Low Transverse)** NORA D. DEAM. *Current Res. Anesth.*, 948, 7-80.

This author gives a clinical résumé of combinations of anesthetics used in 66 low transverse, cesarean sections at the Memorial Hospital, Louisville, Kentucky over a year period. The agents used were combined procaine and pontocaine as a spinal anesthetic, with pentothal sodium intravenously. Preoperatively 1/150 gr. of atropine was given subcutaneously. Fifty milligrams of ephedrine in novocain were injected subcutaneously at the site of the spinal puncture. The solution used was 50 mgm. of procaine crystals dissolved in 5 mgm. of a 2 per cent solution of pontocaine. This solution was mixed with the same needle which was used in mixing the ephedrine novocain for infiltration thus sufficient ephedrine was present to cause a delay in the absorption of the combined anesthetic agent. The solution was further diluted up to 3/4 to 3 c.c. with spinal fluid before injection into the subarachnoid space took place then the patient was placed in a supine

position until the surgeon was ready to make the incision. The patient was shifted to a 35 degree Trendelenburg position and 2 c.c. of 3/4 per cent pentothal were injected intravenously as the incision was made. The amount of pentothal sodium solution given was only sufficient to keep the patient in a degree of sedation comparable to a normal sleep. Oxygen was given to avoid the depression of pentothal.

The presence of dyspnea, especially of cardiac origin, was considered a contraindication to the use of pentothal. In none of the 66 cases reported was resuscitation of the baby necessary. The author presents 3 cases in which the use of the combined anesthetic was indicated. This combination seems to produce adequate anesthesia with a subanesthetic dosage of all drugs used. Side effects and postoperative complications were reduced to a minimum.

MARY KARP, M.D.

**Secoral as a Basal Anesthetic for Children.** MARY FRANCES FOX and MARY KARP. *Current Res. Anesth.* 948, 27-33.

In an attempt to alleviate the psychic trauma of a child undergoing surgical intervention four groups of patients involving 100 cases were given varying proportions of secoral and atropine, or secoral and demerol. The modification evolved combines the dosage of secoral of approximately .05 gr. per pound plus demerol and atropine sulfate. A total of 3 gr. of secoral was not exceeded for it was the intention to produce sedation only in the older child.

**Pontocaine Hydrochloride for Brachial Block Anesthesia: 154 Cases.** DANIEL C. MOORE. *Anesthesiology* 948, 9-28.

Brachial block has become a favorite type of anesthesia for operations on the hand. From 5 to 6 hours operating time was obtained with brachial blocks in which 0.1 per cent or 0.15 per cent pontocaine solutions were employed. Anesthesia was established in from 20 to 40 minutes. Sensory loss occurs ten to twenty minutes before muscular movements are abolished. Successful blocks were obtained in 96 per cent of the cases.

Postoperatively there is no need for an opiate until a period of 6 to 8 hours has elapsed. No complications or injuries to the brachial plexus have occurred from the prolonged action of the pontocaine. Up to the present time no untoward effects have occurred during or following the use of pontocaine. Some of the unpleasant effects of procaine and epinephrine have not been noted. When spinal anesthesia is used with brachial block pontocaine is the drug of choice because of its lasting effects.

MARY FRANCES FOX, M.D.

# PHYSICOCHEMICAL METHODS IN SURGERY

## ROENTGENOLOGY

Roentgenological Manifestations of Intrathoracic Injury Due to Missiles. WILLIAM A. EVANS, JR.  
*Am J Roentg.*, 1948 59 66a

This study is based on observations made in the x ray service of an overseas General Hospital of the United States Army. During a period of 6 months 4 040 battle casualties were admitted approximately 5 per cent of whom had wounds involving the intrathoracic structures.

Roentgen manifestations of thoracic injuries are usually multiple. The most common findings are (1) foreign bodies in the lung (2) lesions of the pulmonary parenchyma (3) pneumothorax and hemothorax, and (4) lesions and foreign bodies in the mediastinum.

**Foreign bodies.** Metallic fragments lying in the substance of the lung are seen frequently. In a large proportion of the cases there is no other evidence of injury to the pleura or lung parenchyma and even after prolonged periods no reaction in the adjacent tissues develops. Not infrequently foreign bodies penetrate close to the mediastinum or hilum. The question arises whether in such instances pulsations transmitted to them may not produce a delayed perforation. This hazard must be balanced against the hazard of their operative removal.

**Traumatic pneumonia.** In several cases an area of infiltration has been observed along the path of the missile suggesting a traumatic origin. The infiltration was rather diffuse in the beginning then it became sharply circumscribed of spherical or ovoid shape and within a few weeks it completely disappeared. Such a lesion most probably represents a hemorrhagic infiltration from rupture of a large blood vessel with subsequent clotting organization and resolution.

**Pleural manifestations.** The most common and most serious complications due to intrathoracic injury have been hemothorax and pneumothorax usually occurring together. Under favorable circumstances the air and exudate will disappear in 2 or 3 weeks. If resolution has not occurred after this critical period of 2 weeks a greatly prolonged course may be anticipated with irreversible changes as sequelae. The blood in the pleural cavity acts as an irritant provoking an outpouring of serofibrinous exudate from the pleural surfaces. Later there is formation of fibrin clots with thickening of the pleura over a collapsed lung. The amount of pleural exudate may continue to increase despite repeated aspirations. In such instances more radical measures become necessary to evacuate the pleural space. If the lung has been collapsed over a long period thoracoplasty may eventually have to be performed.

An interesting observation was the marked tendency to encapsulation of the pleural contents after

the critical period. The encapsulated pocket or pockets as a rule formed posteriorly due to the recumbent position of the patient.

Rarely interstitial emphysema of the chest wall was noted. It was thought that in case of tension pneumothorax the air escapes through a rent in the parietal pleura, accounting for the interstitial emphysema. A complete collapse of the lung and a marked displacement of the mediastinum are strongly indicative of a tension pneumothorax. When both air and exudate escape from the pleural space cellulitis and abscess formation of the chest wall are likely to result.

**Mediastinal involvement.** Cases of foreign bodies in the mediastinum have been rare since the large majority of such injuries are rapidly fatal from hemorrhage. In those patients who survived, a decision as to a later surgical removal of the foreign body was most difficult. Cases have been observed in which a late perforation of a large vessel occurred apparently from a slow erosion produced by vascular pulsation. The presence of a large cardiac shadow in patients with missile injuries of the thorax raises the suspicion of a pericardial effusion.

The author gives the brief histories of 14 more or less typical cases in which numerous roentgenograms were used for illustration. T. LEUCOTIA, M.D.

Roentgen Examination in Acute Dilatation of the Stomach. J. FRANKEN DAHL. *Acta radiol. Stockh.* 1948 29 237

The author presents the roentgen findings in 20 cases of acute dilatation of the stomach to demonstrate some of the most characteristic forms of this condition.

The acute gastrectasias may be divided into the following groups: dislocations and anomalies, primary organic stenosis, secondary stenosis and functional stenosis. According to this grouping gastric dilatation is capable of primary occurrence as an independent disease or it may occur secondarily in which case it must be regarded as purely symptomatic.

The condition of acute dilatation of the stomach is demonstrated on roentgenograms taken upright, supine and in lateral decubitus with or without peroral barium. The dilated stomach with fluid level or levels is visualized.

The group of dislocations and anomalies included a case of gastric volvulus, 2 cases of diaphragmatic hernia and a case of arterioesophageal obstruction. The group of organic stenoses of the stomach included 3 cases of pyloric obstruction and 2 cases of acute phlegmonous gastritis, which showed marked dilatation of the stomach. The secondary dilatations of the stomach included several cases due to inflammatory processes in the vicinity of the pylorus such as cholecystitis and pancreatitis.

Clinically many of the cases of gastrectasia simulate perforated ulcer, ileus, or volvulus of the bowel.  
FRANK L. HUMIST M.D.

**Roentgen Considerations of Pyelonephritis in Small Kidneys.** EUGENE P. FINDERGRASS, RICHARD H. CHAMBERLAIN and FRANK P. BROOKS. *Am J Roentg* 1948, 59: 65

The newer discoveries in regard to the relationship between renal pathology and arterial hypertension have created considerable interest as to the significance of unilateral small kidneys. In interpreting urograms the authors for some time paid attention not only to the gross morphologic changes but to the physiologic and pathologic abnormalities as well. They now report on the result of such analytical observation in the unilateral small kidney with special reference to the findings in atrophic chronic pyelonephritis.

The following scheme of analysis was pursued by the authors:

1. Gross anatomy of the kidneys
  - a. Position, size, shape and axis of the kidneys
  - b. Density of the kidney shadow
  - c. Delineation of the kidney from surrounding structures
  - d. Mobility of the kidney as a whole
2. Roentgenologic quality of clearance of the contrast media
  - a. Selection of contrast medium for testing of tubular or glomerular function or both
  - b. Comparison of clearance from both kidneys
  - c. Comparison of urea clearance with skidodan excretion
  - d. Determination of delay in excretion
3. Anatomy of the renal pelvis and calices
  - a. Number and configuration of the calices
  - b. Character of the filling
  - c. Position of the renal pelvis, intrarenal or extrarenal
  - d. Relative proportion of the medulla and cortex
4. Physiology of the renal pelvis and calices
  - a. Character of the peristalsis
  - b. Elasticity of the pelvic structures and consideration of the reversibility of any dysfunction
  - c. Disturbance in emptying

**Pathology of unilateral small kidney.** A significant smallness in size of a kidney may be the result of malformation in development, of atrophy from acquired disease or of both. It is not possible to make the distinction between the two types clinically. It was hoped that roentgenologic means might lead to a better result. However the differential features in certain cases appear too subtle to be of value although pertinent indications as to the nature of the abnormal kidney may be shown.

**Hypoplasia of the kidney.** This is defined as a kidney which is small as a result of defective development but which contains functioning normal tissue. Its incidence at autopsy has been quoted as varying between 1.000 and 2.3,000.

**Acquired atrophy.** The most important diseases responsible for an acquired unilateral renal atrophy are (1) atrophic chronic pyelonephritis (2) primary atrophy and (3) pyonephrosis.

Atrophic chronic pyelonephritis represents the most frequent cause. Hage, for example, reported 69 contracted pyelonephritic kidneys in 9,888 autopsies. The mode of its pathogenesis is difficult, if not impossible to evaluate by any means except for the classical division into the ascending and hematogenous forms. The basic pathologic change of a small pyelonephritic kidney is characterized by cortical scarring which has replaced glomerular and tubular structures with corresponding thinning of the cortex. On urographic examination this change is manifested by the demonstration of fixation, loss of elasticity and loss of peristalsis.

A primary atrophy of the kidney is observed rarely. It may occur in anuria from obstruction, but the unique mechanism of hydronephrosis is the usual reaction of the kidney to such obstruction.

Pyonephrosis is defined as a secondarily infected hydronephrosis. The small kidney resulting from this condition is indistinguishable pathologically and roentgenographically from atrophic chronic nephritis.

**Roentgenologic considerations.** This division of the origin of the small kidney appears to be rational but, from the roentgenologic standpoint there are the following interesting observations which are difficult to explain: (a) the small kidney with or without urographic evidence of pyelonephritis found on the first examination in every case studied by the authors except one which showed a small diminution in the size of the kidney after 4 years, (b) the fact that the condition has occurred in both children and adults, (c) many cases of pyelonephritis are observed in which the kidneys are not small, and in bilateral pyelonephritis only one kidney has appeared to be small in practically every instance and (d) small kidneys, presumably hypoplastic, were observed in patients in whom there was no clinical evidence of disease.

The authors found altogether approximately 60 cases of unilateral small kidney. In addition to the diminution in size there was often an unusually sharp demarcation of the renal contour from the surrounding soft tissue densities. The mobility of the kidney as a whole was restricted in many cases, such fixation probably being the result of capsular inflammatory changes. The ability to clear the intravenous contrast medium was frequently impaired.

Some information was also gained from a study of the anatomic aspects of the renal pelvis and calices, from an evaluation of the relative proportion of the medulla and cortex of the kidney, and from a serial examination of the physiology of the renal pelvis and calices in the supine Trendelenburg and semierect positions, best accomplished with the excretory contrast method.

Ten illustrative cases are briefly reported with reproduction of the respective roentgenograms.

T. LEONARD, M.D.

**Bone and Joint Lesions in Leprosy** A Radiologic Study GONZALO ESCOBARRA GÓMEZ and EMILIO ACOSTA. *Radiology* 1948 50 619.

An extensive roentgenographic analysis was made of the hands and feet of 532 patients. Of this group 483 were known to be afflicted with leprosy 5 were suspects and 44 were normal.

The leprosy patients were classified according to the International Congress of Leprosy (1938) as neural or lepromatous (cutaneous) types. The two groups were subdivided as minimal, moderate or advanced with a mixture of the main groups as well.

Of the 483 leprosy patients, 365 were males and 118 females. The ages of patients ranged from infancy to 90, the incidence being greatest in patients between 30 and 50 years of age.

Decalcification and rarefaction, producing a vacuole appearance, were frequently observed in the epiphyses of the phalanges, and in the metacarpal and the metatarsal bones. In some instances the cortex expanded and ruptured under pressure. Vacuole appearance is due to nerve damage or to the growth of Hansen's bacilli in the bone marrow and osseous tissue. Decalcification may be caused by impaired circulation due to destruction of sympathetic fibers of the nutrient arterioles, nerve disorder due to poor condition of afferent nerves and disturbed calcium metabolism. The results of disturbed calcium metabolism remain contradictory and doubtful.

Hypertrophy and hyperostosis occur at the articular ends of the phalanges, the metacarpal or the metatarsal bones and produce deformities. In some instances the bony deformity is hooded.

Reabsorption may be of a simple type or may follow atrophy. It occurs in both the neural or cutaneous types of the disease. Simple reabsorption appears as an osteitis of the distal phalanges. Small erosions may be seen. This type of absorption begins with an onychia. The proximal end of the phalanx may become involved and produce an increased density and expansion of the phalanx so-called "hood." Eventually the bone is destroyed and the joint is involved.

Reabsorption following atrophy produces a thin distal phalangeal diaphysis which tends to become conical in shape. The appearance at one stage may resemble a collar button, eventually only the proximal portion of the phalanx remains with a hood image. Middle phalangeal involvement is characterized by a diabolical form. Fractures are frequent. Proximal phalanges show joint distortion and muscular atrophy.

Mutilation may affect all four extremities stopping at the carpus and Lisfranc's articulation. Perforating plantar ulceration of the anterior inner aspect of the foot with bone changes suggesting osteomyelitis may also occur. However, epiphyseal location at the first metatarsal and proximal phalanx, plus soft tissue destruction, should be sufficient to warrant a diagnosis of leprosy. Healing takes place through ankylosis. Osteomyelitis (whitlow type) can

be differentiated from a true osteomyelitis by the absence of pain.

Of the 483 leprosy patients examined, 306 presented radiological evidence of involvement of the hands and feet. Of the remaining 177 patients, 68 per cent showed suggestive but not conclusive roentgen findings of leprosy.

MAURICE D. SACHS, M.D.

**Atlanto-Occipital Fusion, Occiput Terminale and Occipital Vertebra as Related to Basilar Impression with Neurological Symptoms.** LEX A. HADLEY. *Am J Roentg* 1948, 59 511.

The author presents 6 cases of congenital anomalies occurring at the foramen magnum. In 1 case the condition was an occipital vertebra, in 4 cases undoubtedly, atlanto-occipital fusion and in 1 case the features of both were present. In 5 of the patients, asymmetry with tilting of the head was shown and in 4 foramen distortion. Several other anomalies were present in these cases.

In occipital vertebra, the atlas is present and the malformations surround the foramen magnum. There may be hypochondral arch, partially or completely fused to the anterior margin of the foramen magnum, this may bear a third condyle for articulation with the odontoid. This condyle may be either an articular depression or a single tuberosity with an articular facet. Bilateral bony masses or accessory eminences may encroach upon the anterior part of the foramen magnum. These various bony tuberosities and masses develop in the ligamentous tissue about the foramen. A partial or complete neural arch may be outlined about the dorsal surface of the foramen. Transverse processes may or may not be present, more or less fused with the bones of the skull. If present, they do not bear a foramen for the vertebral artery. The condyles resemble those of the normal subject and an occiput terminale may be present.

In atlanto-occipital fusion, the differentiating value is the shape of the condyles. On the occipital vertebra, these are oval and convex, and in the anteroposterior view their articular surfaces face laterally in a caudal direction. The condyles on the under surface of an assimilated atlas, however, are flattened and their surfaces visualized in the anteroposterior view are directed medially in a caudal direction. In a case of atlanto-occipital fusion, the articulation above the atlas is lacking on one or on both sides. Flexion-extension studies will reveal a fixation of movement between atlas and occiput. The transverse processes bear foramina for the vertebral arteries. There is a space between the dorsal arch of the atlas and the occiput for passage of the suboccipital nerve and the vertebral artery. There is an articulation on the anterior arch for the odontoid. As with the occipital vertebra, the accessory eminences on one or both sides may encroach upon and distort the foramen magnum. The anterior arch or the posterior arch may not be completely fused with the occiput. Nonsegmentation may have occurred only on one side.



Good stereoscopic roentgenograms are much superior to planigrams. A lateral survey film with the head at full limit of the forward flexion should detect nearly all cases. The foramen magnum may be visualized by either the vertex-occiput or the occiput-vertex projections with some distortion. Other films to visualize the odontoid process, the planes of the atlanto-occipital and the atlanto-axial articulations are taken.

Early operation offers the promise of arresting the progress of the condition, although restoration of normal relationships is impossible. If a congenital anomaly of the above types is discovered in a young child not yet showing symptoms, the parents should be acquainted with the possibilities and remain alert for the first appearance of neurological signs. These may not appear until the second or third decade.

FRANK L. HOWES M.D.

**A Method of Roentgenologic Examination of the Shoulder** WILLIAM E. HOWES and B. BRUCE ALCHAMPEL *Radiology* 94:5 50, 56p.

Routine roentgenograms of the shoulder girdle, namely, the anteroposterior views with the hand in external and internal rotation. In many instances are not adequate to warrant an accurate diagnosis.

Anatomic studies of the skeleton were made in an effort to determine the insertion areas of the short rotators and of the subscapularis tendon. It was soon obvious that the best way to demonstrate calcifications or chip fractures would be through the use of multiple tangential views. The following five views were found to be necessary:

1. To demonstrate the infraspinatus tendon, the shoulder is elevated at a 33 degree angle with the hand in external rotation.

2. To demonstrate the supraspinatus tendon the angle board is removed and the hand is held in supination.

3. To demonstrate the teres minor tendon the hand is held in internal rotation.

4. To demonstrate the subscapularis tendon (axillary view with the patient sitting) the arm is held in abduction, the central ray is angled medially and cephalad through the axilla.

5. To demonstrate the bicipital groove and tubercles the hand is held in supination and the main ray is directed from the elbow medially and cephalad at a tangent toward the bicipital groove.

By utilization of multiple tangential views accurate localization of calcifications or fractures can be established.

MAURICE D. SACHS, M.D.

**Tumor Dose in Cancer of the Larynx.** CHARLOTTE P. DOXIAK. *Radiology* 94:5 50, 463.

The technical factors, dosage and results of the treatment of cancer of the larynx reported by Blady and Chamberlain, Howes and Platau and Cutler are compared with those of the treatment of 113 patients with cancer of the larynx at the Radiotherapy Department of the Presbyterian Hospital, New York, from April 27 1938 to November 31 1944.

During this period the technique and dosage varied considerably in the author's series. In the latter part of this period, she used 200 kv. 25 ma. 50 cm. STD and 1 mm. of copper plus 2 25 mm. of aluminum filter were used. The average daily dose was 115 roentgens in air to each of two lateral portals 7 cm in diameter. Earlier she used 10 by 10 fields with an average daily dose of 350 roentgens in air.

The total tumor dose in the author's series and the various other reported series closely approximated 5,000 roentgens.

Comparison of the results obtained in the author's series showed very little difference between the techniques used in the earlier and later cases. The results of the various authors are also similar except that Cutler reports a larger percentage of 5 year cures with 400 kv and two treatments daily.

VERNA W. RUTHER M.D.

**Mammary Cancer** G. E. RICHARDS. *Brit. J. Radiol.* 1948, 24p.

The author discusses some radiotherapeutic procedures currently used in the treatment of mammary cancer. These include (1) telerradium therapy (2) 200 kv roentgen therapy and (3) 400 kv roentgen therapy.

In 1933 the treatment of primary carcinoma of the breast by means of telerradium was commenced at the Ontario Institute of Radiotherapy in Toronto. A 4 gm. radium element (salt) unit was used. Concurrently a similar group was treated with 200 kv roentgen therapy for comparison. In none of the patients so treated was cancer eradicated from the breast. This was rather disappointing especially as it concerns the radium but perhaps the small size of the beam limiting its usefulness to small primary lesions might explain the cause of the failure.

In 1938 400 kv roentgen therapy was introduced. The skin and tissue reactions from this type of treatment were found to be much less troublesome and the method has resulted in eradication of cancer in 17 per cent of the cases; therefore the author is convinced that 400 kv roentgen therapy has many points of superiority over either the telerradium or the 200 kv roentgen therapy.

In the treatment of the primary tumor wherever possible 4 converging tangential portals of 10 by 20 cm. are used superior inferior medial, and lateral. Doses have been calculated for two planes (a) plane X, which represents the junction of the middle and outer thirds of the breast and (b) plane Y which represents the base of the breast just overlying the pectoral muscles. From the attached dosage charts it can be seen that if 200 kv are used and a dose of 1,500 roentgens is administered per portal, plane X will receive a total of 2,430 to 3,240 roentgens whereas with 400 kv and a dose of 1,800 roentgens per portal it will receive approximately 3,500 roentgens. Under identical conditions plane Y will receive a total of 1,870 to 2,240 roentgens and about 3,500 roentgens respectively. Since the average curative dose must reach approximately 5,000

roentgens the doses given must be considered despite the excessively severe skin reactions as still being too small to eradicate every cancer from the breast.

Treatment of the axilla. For this purpose 3 portals are used: an anterior, a posterior, and a direct portal into the axilla, with the arm abducted as fully as possible. With 3 such portals, each receiving 1,200 roentgens, the depth dose in the center of the axilla will be 2,000 roentgens which is too small. By using an additional superior portal directed downward from the point of the shoulder the dose in the apex of the axilla is raised to 3,500 roentgens. The results obtained by such technique amounted to 35 per cent.

Treatment of the supraclavicular area. Here tele-radium therapy is used to advantage. A 6 cm. circular beam is directed from several converging angles into the supraclavicular triangle effecting a fairly satisfactory crossfire technique. By this means 50 per cent of the palpable nodes were made to completely disappear. Next to tele-radium therapy in effectiveness is the 400 kv roentgen therapy. With this agent 3 portals are used for cross-firing: an anterior oblique (which also includes the infraclavicular space), a superior lateral direct and a posterior oblique portal. A cone 6 by 8 cm. is employed; the doses ranging from 900 to 1,500 roentgens per portal depending upon the individual skin tolerance.

Dosage charts are given (1) for the treatment of the primary tumor indicating (a) the dosages through plane X at 400 kv and 200 kv and (b) the dosages through plane Y at 400 kv and 200 kv and (2) for the treatment of the axilla (a) if 3 portals are used showing the dosages at 400 kv and 200 kv and (b) if 4 portals are used showing the dosages at 400 kv and 200 kv.

T. LECUTIA, M.D.

#### The Influence of Castration with Roentgen Rays on Carcinoma of the Breast. VIGGO E. THAYSSER. *Acta radiol.* Stockholm, 1948, 39: 189.

The author compares the results of treatment of 99 patients with breast cancer and metastases or recurrences who were treated at the Radium Center in Copenhagen by roentgen ray irradiation over the ovaries with the results in a similar group of 100 patients who were not subjected to castration. The 99 patients were given both local treatment of the primary tumor and the metastases and roentgen treatment of the ovaries at some time or other after the appearance of the metastases whereas the 100 patients received only local treatment.

Of the 99 castrated 72 were treated with roentgen rays before the menopause, the remaining 27 were treated during the menopausal change or until 12 years after this period. The youngest patient was 26 years old at the time of castration, the oldest 59. All of the patients in the first group of castrates menstruated regularly but those in the second group had either shown signs of an incipient menopause or their menses had definitely ceased. The castration was accomplished with two routine doses of 250 roentgens on each of four fields (10 by 15 cm.) on the lower part of the abdomen: two anterior and two

posterior, with 180 kv, 15 ma. a distance of 40 cm. and a filter of 0.5 of copper. In 24 cases 1,000 roentgens were given to four fields but seemingly without greater effect than the other doses. There were metastases in all of the cases at the time of castration.

In the 100 noncastrated patients the treatment with roentgen rays to recurrences and metastases was essentially the same as in the castrated ones. The average age of the 100 patients was 45.6 years corresponding to an average age of 43.5 years for the castrates.

Of the castrated patients 40 per cent had a survival of 2 years or more after their appearance while the corresponding figure for the controls was only 11 per cent. After 5 years 20 per cent of the castrated patients were still alive while all of the patients in the control group had died. Of 74 who had received roentgen treatment before or after operation and had been castrated 28 per cent were alive 5 years after the operation as against 8 per cent of the controls.

On the basis of 79 urine assays 41 for gonadotropin and 38 for estrogen it was shown among other things, that the castration may have had a highly beneficial effect even in cases in which the estrogen output was low before castration.

Castration therapy is not certain to prove effective but it may be concluded that in one-third of the cases it will result in temporary improvement of the patient's condition. It may be the means of obtaining some additional years of life in relative comfort for the patient and it may also prolong life to some extent.

FRANK L. HURSEY, M.D.

#### Roentgen Treatment of Cancer of the Esophagus. JACOB R. FREID. *Am. J. Roent.* 1948, 59: 551.

The author re-evaluates the present-day treatment of cancer of the esophagus and describes his experience with roentgen therapy at Montefiore Hospital. He reports the case of a patient who is well more than 7 years following roentgen therapy.

A review of the literature shows that in operable cases surgery is the treatment of choice. However since by far the majority of these growths are inoperable, roentgen radiation constitutes the most commonly used treatment.

Contraindications to the use of radiation therapy are (1) infection, (2) severe anemia, and (3) cachexia and emaciation.

The methods of irradiation include (1) interstitial radon seeds (2) intracavitary radium tubes (3) telecurietherapy (4) roentgen therapy and (5) the combined technique consisting mostly of an association of radium therapy with external roentgen therapy.

The factors governing the response of the esophageal carcinoma to irradiation are (a) radiosensitivity (b) clinical character of the neoplasm (c) stage of the disease (d) accessibility and (e) previous treatment.

At Montefiore Hospital the following method of irradiation is used: 200 kv or 400 kv (the latter

being preferred) 3 anterior and 3 posterior portals with the patient lying flat or being in a sitting position 100 roentgens with 400 kv to each of the six fields daily until a tumor dose of 6,000 to 7,000 roentgens is reached in 6 weeks or 500 roentgens with 300 roentgens to two or more fields, for a period of 6 weeks. Under ideal conditions the daily dose to the tumor should be approximately 300 roentgens and not less than 150 roentgens.

The complications and injuries include (1) severe changes in the lungs and mediastinum following intensive irradiation (2) dysphagia following well planned irradiation, which may be due to scar formation and contraction of the esophagus (3) aggravation of coexistent pulmonary and mediastinal tuberculosis and (4) perforation complicating fractionated roentgen therapy of moderate dosage. Examples of all these possibilities are given and illustrated with roentgenograms.

The number of patients treated was 13. With the exception of one, all received roentgen therapy exclusively. The average survival from the time of treatment amounted to 11 months as compared to the 5 to 8 months survival from the onset of symptoms quoted in the literature for nontreated patients.

Autopsies, some time after irradiation were performed on 4 patients. In 3 of the patients there was no evidence of carcinoma, and in the fourth patient only a few degenerating carcinoma cells were found. The one patient who is well after a period of 7 years is from the author's private practice. This case is described in detail.

A bibliography of 23 articles is appended.

T. LECOTIA, M.D.

#### Primary Tumors of the Small Intestine. CARROLL C. DUNDON. *Am. J. Surg.* 94:8, 59-69

The author reviews 62 cases of tumors of the small bowel from the records of the University Hospitals of Cleveland, for the years 1933 to 1946.

Eighteen cases of malignant tumors were recorded in 13 of these the patients had symptoms referable to the gastrointestinal tract, or had a palpable mass in the abdomen. The incidence was 1 tumor to 3,000 admissions on the surgical service, or 1 tumor to 9,000 general hospital admissions.

There were 44 benign tumors only 2 of which caused clinical symptoms these 2 were pedunculated and caused intussusception.

Of the 18 malignant tumors, 3 were found in the duodenum, 8 in the jejunum, and 7 in the ileum. (Tumors of the ampulla of Vater are not included in this report.) There were 12 carcinomas—3 in the duodenum, 5 in the jejunum and 4 in the ileum. Two lymphosarcomas and 1 leiomyosarcoma occurred in the jejunum. One fibrosarcoma and malignant carcinoids were found in the ileum.

The average age of the 8 patients with malignant tumors was 43 years, and the age range was from 21 to 76 years. There were 10 males and 8 females. The chief complaints of the 18 patients with malignant tumors of the small intestine were

abdominal pain in 9 cases, vomiting in 3 cases, and diarrhea and weakness in 1 case each.

Six patients had no symptoms referable to the gastrointestinal tract, although 1 of these had a large abdominal mass. Abdominal pain existed in 9 of the 18 patients for an average period of 15 months. Nausea and vomiting occurred in 5 patients, with an average duration of 11 weeks. Mild and intermittent diarrhea existed in 3 cases for an average period of 9 months. Five patients had melena in 2 of these the melena was severe having appeared as a terminal event and as the immediate cause of death. Intussusception occurred in 4 cases. A tumor mass was palpable as an abdominal mass in 6 patients. Loss of weight was severe in most cases.

Eight of the malignant tumors were infiltrating in type and 9 were polypoid. Three of the polypoid tumors were pedunculated.

Necrosis of the tumor with ulceration and hemorrhage developed in 5 cases.

Both of the patients with lymphosarcoma had focal involvement.

Metastases or local extension to adjacent organs had occurred in 16 cases when the tumors were discovered. Distant metastases of the lung and brain were found in 1 case each before the primary tumors were discovered.

A review of the roentgenograms revealed definite changes in 8 cases which might have led to a correct diagnosis if complete studies had been made.

Eight patients had barium studies. Four showed narrowed loops of small intestine 3 had complete obstruction to the passage of barium through the jejunum 1 showed dilatation of the intestine at the site of the lesion and 1 patient had marked hypermotility.

The author states that patients who have persistent abdominal pain, either intermittent or constant, and patients with vomiting, melena, or diarrhea which remains undiagnosed after routine studies of the gastrointestinal tract, gall bladder, and urinary tract, deserve special study of the small intestine to exclude a primary tumor.

FRANK L. HUNST M.D.

#### Roentgen Treatment of Multiple Myelomas. L. HENRY GARLAND and BAYLES R. KIMMEL. *Radiol.* 92:5, 94:8, 50: 297

The authors review the literature and the results in a series of 13 cases of multiple myeloma which were treated by the use of roentgen therapy to determine the value of this type of therapy. Eight of the cases were proved microscopically and 5 had sufficient clinical, laboratory and x ray evidence for the diagnosis. Six of the patients treated showed improvement in their condition, 6 were not appreciably benefited, and one had incomplete treatment. One of the patients survived more than 9 years and is still living. The average survival for the remaining treated patients was 14 months, while that of the untreated patients which the author mentions as 23 months.

The physical factors were as follows 200 kv half value layer of 1.2 mm of copper. The target skin distance and field size varied according to the sites treated (commonly used distances were 70 cm. and the fields were 20 cm in diameter). The dose in roentgens was measured in air without backscatter. The dosage that the patients received varied considerably. It is believed that adequate irradiation of patients with multiple myeloma is still worth attempting.

Multiple myeloma is not a radiosensitive disease. Solitary myeloma appears to be radiosensitive and a radio-controllable disease in certain instances and should be treated by vigorous roentgen irradiation when the diagnosis is established microscopically. Multiple or solitary myeloma with spinal cord compression and paresis or paraplegia appears to be well worth irradiation (following laminectomy). In the literature survivals for as long as 7 years have been recorded.

FRANK L. HUSKEY M.D.

Roentgen Therapy in Traumatic Myositis Ossificans. ERNEST A. POHLZ and CAROL TOMLINSON. *Am J M Sc* 1948 215 372

The authors review the etiology pathology pathogenesis and clinical findings in traumatic myositis ossificans.

After pointing out that early surgical removal is usually contraindicated because of the possibilities of recurrence they describe their technique of roentgen therapy for this condition. With 275 or 400 kv 50 cm focal skin distance (half value layers of 1.05 mm of copper and 2.4 mm of copper) they deliver doses of from 150 to 200 roentgens in air to one or two fields daily or every other day for 3 or 4 treatments. A second series in from 4 to 6 weeks was given in some cases and a third series in from 2 to 4 months after the first course was occasionally necessary.

They have treated to patients with relief of pain in all of them. This was often noted 2 or 3 days after treatment and always after from 4 to 6 weeks. In most of the cases there was a slight decrease in the size of the calcified area. Limitation of motion showed marked improvement.

The authors believe that these beneficial results in a small series justify further trial of roentgen therapy in traumatic myositis ossificans.

JOHN O. LATTERY M.D.

Lymphoid Tumors. HEOR F. HARE, WILLIAM C. MURPHY and C. FRANKLIN SORNFELDER. *Radiology* 1948 50 507

The authors believe that early diagnosis and treatment of lymphoid tumors constitute the only approach to success in the treatment of lymphoid tumors. In a series of 151 cases diagnosed clinically and histologically as lymphoid tumors during the years 1914 to 1942 inclusive 40 patients (26 per cent) were living well at the end of 5 years and 2 others were living with recurrence of their disease. During the period of observation 30 per cent of the

patients had recurrent involvement of nodes locally or at a new site requiring treatment. Thirty seven, or 71 per cent of the 52 patients living showed no recurrence following the initial treatment during the 5 year period of observation. The results then would indicate that if the disease is adequately treated when localized a significant number (29 per cent) will obtain a 5 year survival.

The onset of lymphoid tumors is insidious. In approximately 61 per cent of cases it is first noted as an enlargement of the lymph nodes in the neck. The enlarged nodes frequently follow an upper respiratory infection and subsequently recede only partially or not at all. The disease may originate in any part of the body and may become generalized before diagnosis is considered. It is important that a biopsy specimen be taken in each instance as soon as the nodes are discovered. All of the enlarged glands in the cases of Hodgkin's disease do not reveal evidence of the disease. Roentgen therapy may be used as a method of diagnosis when the nodes are not accessible for biopsy.

Irradiation of localized lymphoid tumors must be directed to all palpable nodes and to the area surrounding the tumor bed with a total dosage of 2,400 roentgens delivered to the tumor 200 kv p with copper filtration, half value layer 1.6 mm copper is used. Mediastinal involvement may be of the sclerous type, and at least 1,200 to 1,500 roentgens should be delivered to the tumor in the first course to establish the diagnosis. Two weeks after treatment comparative roentgenograms are made and if the lesion is considered to be radiosensitive treatment to the fullest extent should be carried out. Localized disease of the gastrointestinal tract is the most amenable to surgery. The treatment of generalized disease in most instances is for palliation only 1,200 to 1,550 roentgens measured in air is usually sufficient to bring about palliation and shrink the nodes enough to relieve pressure symptoms. Supportive measures and treatment of other symptoms should also receive attention.

FRANK L. HUSKEY M.D.

Engelmann's Disease. H. R. SEAR. *Brit J Radiol* 1945 21 236.

The rare congenital bone dystrophies associated with osteoclerosis fall into five main groups as represented diagrammatically in Figure 1. They are:

- 1 Osteopetrosis or marble bones
- 2 Engelmann's disease or osteopathia hyperostica
- 3 scleritis multiplex infantilis
- 4 Melorheostosis or Leri's disease
- 5 Osteopoeclia or spotted bones

epiphyseal epiphyses

Engelmann's disease is the rarest of these this being the first reported case since Engelmann's single case in 1909. His case of an 8-year-old boy of whom roentgenograms showed bilateral symmetrical expansion and thickening and sclerosis of the diaphyses of all the long bones. No involvement



Fig. (Sear) Rare congenital bone dystrophies associated with osteosclerosis.

of the ends of the diaphyses or epiphyses was present. The skull showed thickened patches in the frontal bone and base of the anterior and middle cranial fossa, and thickening and sclerosis of the orbital roofs. The child showed a stature below normal with apparent lengthening and bowing of the legs, a short neck, flat feet, and lumbar lordosis. No other gross abnormalities were present and the history and laboratory studies were not significant.

Sear's case was that of a boy, years old of whom roentgenograms also showed dense osteosclerosis of the central portions of the shafts of the long bones, especially pronounced in the clavicles, forearms, femora, and tibia. The skull showed dense thickening and osteosclerosis of its base extending into the frontal bone. A history of some difficulty in walking from the age of 3 years was elicited and marked wasting of the leg muscles giving an apparent leg lengthening was noted. Biopsy showed very dense but essentially normal bone structure. Laboratory findings were not significant.

Engelmann's disease is differentiated from osteopetrosis, which gives a similar appearance in the skull by the central involvement of the long bones, sparing the ends of the diaphyses and epiphyses, and also by the absence of changes in the vertebral ribs, and bones of the hands and feet.

Infantile cortical hyperostosis of Caffey and Silberman is a disease of infancy characterized by sudden onset fever, asymmetrical bony involvement and slow return to normal. The mandible is most likely to be involved in the skull. The bone lesions are accompanied by painful soft tissue swelling. This is in contrast to the symmetrical involvement, changes in the base of the skull, and persistence of the lesion for 8 to 10 years which were seen in these

3 cases of Engelmann's disease, the rarest of the congenital condensing bone dystrophies.

ALLAN K. BRINTY, M.D.

#### MISCELLANEOUS

Effects of Radioactive Sodium on Leucemia and Allied Diseases. T. C. EVANS, M. LEVY, C. P. DOWLAN and M. J. LEBLAY. *Am J Roentg* 94:3, 57, 469.

The authors present a report of the results obtained following the use of radioactive sodium in the treatment of 24 patients with leukemia and allied disorders. The amount of radiosodium excreted was found to be less than 10 per cent of the dose administered. The percentage of radiosodium excreted appeared to be related to the individual patient rather than to the amount of radiosodium administered, or to the amount of urine excreted. The distribution of radiosodium was determined by examining the tissues taken at autopsy from 3 patients who died about 48 hours after the administration of radiosodium. No marked concentration of radiosodium was observed in any of the tissues, although the concentration was somewhat higher in the vertebra, liver and kidney and slightly lower in the muscle and intestine.

With regard to the 5 preliminary cases in this series (1 patient in the terminal stage of Hodgkin's disease, 3 patients in the terminal stage of lymphocytic leukemia and 1 patient in the terminal stage of myelogenous leukemia) the results were such that the authors were encouraged to carry out additional studies on the treatment of chronic leukemia. Three patients with chronic myelogenous leukemia who had undergone previous radiation therapy and 4 who had

not had previous radiation therapy 4 patients with subacute and acute myelogenous leucemia, 2 patients with chronic lymphatic leucemia who had not had previous irradiation and 1 who had had previous irradiation and 2 patients with acute lymphatic leucemia, were treated. In this same series 1 patient with polycythemia vera and 1 with sympatheticoblastoma also were treated.

The final evaluation of radiosodium therapy can not be obtained from the limited number of cases in this series. Radiosodium however by mouth in a suitable quantity and taken at suitable intervals is effective in reducing symptoms of chronic myelogenous leucemia chronic lymphatic leucemia, and polycythemia vera. The rate of response of each treatment appears to be intermediate between that of roentgen therapy and treatment with radiophosphorus. The contraindications are similar to those for other forms of radiation therapy. The response to radiosodium therapy is not good when the disease is acute the radioresistance of the abnormal cells is high and the hemopoietic system is already damaged.

FRANK L. HUSSEY M.D.

The Treatment of Keloids at Radiumhemmet, 1921-1941  
FOLKE JACOBSSON *Acta radiol* Stockh. 1948 29 251

Keloids are benign proliferative fibrous tissue overgrowths. According to current opinion they are not regarded as tumors. However the growth is often very tumorlike. Radium or roentgen ray therapy is the method of choice in the treatment of keloids. At Radiumhemmet 625 patients with keloids have been treated during 1921 to 1941. In 563 cases the keloid was confined to one part of the body. In 62 patients keloids were distributed on two or more parts of the body. There was a preponderance of women. In 112 cases the keloid had earlier been surgically excised.

one or more times with subsequent recurrence. Five hundred and forty nine patients were treated with radium 124 with radium and roentgen and 25 exclusively with roentgen. The keloid was excised in 27 cases and then within 10 days the scar was phyliactically irradiated.

In the use of radium clinical experience has shown that conformity between dosage and skin reaction will be found if the dose has been calculated in accordance with the average of the intensity at a central surface point and at each successive point down to the depth of 1 cm. The dosage now is always calculated as average dose in 1 cm. tissue layer according to Strandquist this dose is approximately the same as the dose at a depth of 3 mm. under the surface. The unit of radiation intensity chosen is 5 units per hour having a value of 7.5 roentgens per hour equivalent to 1 millicurie. The dosage since 1936 has varied between 600 and 1 200 roentgens usually between 850 and 1 000 roentgens. As an example of the treatment time it may be mentioned that 900 roentgens are delivered in 2 hours by an applicator containing 10 needles (100 mgm. radium) arranged in one row. Roentgen treatments were given to thick and large keloids not suitable for radium treatment. Sometimes single but usually divided doses were given. The total doses have been more than 1 000 roentgens (with backscatter) in 21 cases (in 10 more than 1 500 roentgens) and in 22 only one series of treatments was given. Care should be taken in keloids caused by burns. After total doses of more than 1 000 roentgens the skin seems to be easily damaged. The best results seem to be achieved if the keloid is of less than a year's duration. Total regression of keloid was obtained in 73.6 per cent considerable in 14.4 per cent evident in 9 per cent slight regression in 1.9 per cent and an unsatisfactory effect in 1.1 per cent.

FRANK L. HUSSEY M.D.

## MISCELLANEOUS

### CLINICAL ENTITIES—GENERAL PHYSIOLOGICAL CONDITIONS

**Protein Deficiency** JOHN D. STEWART, HARRY W. HALE, JR., and SHERMAN M. SCHAEFER, *J. Am. Med. Ass.* 1943, 36 017

The present article is concerned with some of the practical aspects of protein nutrition in the surgical patient who may constitute a difficult problem because of his inability to eat due to various causes. Intravenous injection of whole blood plasma, serum, and various prepared mixtures may be the only feasible method of supplying protein in quantity.

The requirements to be met by the solution of amino acids to be used intravenously are: (1) the aqueous solution must be stable and contain a suitable concentration of the essential amino acids; (2) it must produce only minimal changes in the acid base and water balance; (3) it must be nontoxic, nonallergenic, sterilizable, readily available, and inexpensive. The authors utilized a sterilized, aqueous nonpyrogenic, 5 per cent solution of an enzymic hydrolyzate of purified casein and pork pancreas to which dextrose had been added in 5 per cent concentration. The hydrogen ion concentration was adjusted to a value of 6.5. A liter of the solution supplies 50 gm. of amino acids and 50 gm. of dextrose. It is given intravenously once or twice a day in no less than 3 hours per injection.

A variety of conditions in many patients (as much as 90 liters were given to a single individual over a period of 3 months) were treated with the mixture. The incidence of a toward reactions was about 6.5 per cent, the most severe of which seemed to be nausea and vomiting. A point of importance for the severely dehydrated acidotic patient is the occurrence of a definite lowering of the carbon dioxide combining power of the plasma after its administration in quantity. In a considerable experience the authors have found nothing to contraindicate casein hydrolyzate therapy in the presence of grave hepatic disease. Charts are presented to substantiate this statement. The need for other essential dietary constituents such as calories, vitamins, and minerals, among others, must be kept in mind.

For patients with lesions of the upper gastrointestinal tract, intrajejunal feeding is recommended. A jejunostomy may be a modified Witzel technique, made from 18 to 24 inches beyond the ligament of Treitz under local anesthesia, and with a 16F catheter was done by the authors. A satisfactory mixture for jejunal feeding must meet the following requirements: (1) the mixture should be complete with adequate amounts of the elements of the normal diet; (2) it should be fluid enough to drip by gravity through a small catheter; (3) it should be neutral in reaction and contain enough colloid to protect the intestinal mucosa against irritant salt action.

(4) it should be easily prepared, inexpensive, capable of being varied to meet individual needs, and should keep at least 48 hours under refrigeration; and (5) it should yield a low residue and be easily digested and absorbed. A formula, utilizing water, sucrose, casein, yeast, trypsin, vitamins and minerals, is given in detail as well as the chemical analysis which it yields. This mixture is given each day over a 12 hour period in 3 or 4 ounce injections every half hour. Cramps, nausea and diarrhea may occur if too much is given at one time. This method has been utilized in the alimentation of patients with a variety of conditions including obstructive jaundice and hepatic damage. A brief discussion follows the paper.

ALLAN D. CALLOW, M.D.

**The Mechanism of Delayed Death following Thermal Trauma.** H. C. BERGMAN, H. E. KROGER, and ALFRED PRINCEMETAL, *J. Lab. Clin. Med.* 1943, 33 304

The authors performed experiments on mice and rats to determine the mechanism of delayed death following thermal trauma.

Previous observations have shown that burn shock was accompanied by a reduction in the circulating blood volume as represented by the bleeding volume, and that two major factors were implicated in this reduction: (1) local fluid loss, and (2) atony of the vessels comprising the capillary bed of the visceral organs.

The bleeding volume was ascertained by removing the heart and mopping up the blood entering the thoracic cavity with weighed cotton pledgets. The presence and degree of capillary atonia were determined by measuring the amount of hemoglobin retained in the liver. The techniques and methods employed are described in detail.

Observations showed that a number of animals died at various time intervals: 300 mice scalded to the head in water at 60° C. for 7 seconds and 80 rats scalded to the head in water at 65° C. for 10 seconds died from the second day to more than a month later. This investigation was undertaken primarily to determine the bleeding volume and the degree of capillary atony in surviving animals in an attempt to elucidate the mechanism of delayed death after thermal trauma. The experimental results are recorded in a series of graphs. The observations were begun 2 hours after the burn and continued for 31 days.

In mice capillary atony and a decreased blood volume were demonstrated during the period in which the symptoms of shock were present. Upon the subsidence of these symptoms (generally within 24 hours) the blood volume was restored to its normal value, the capillary atonia disappeared and there was no further reduction in blood volume or reappearance of visceral congestion throughout the period of observation.

In experiments on rats after similar thermal trauma the bleeding volume showed a small but insignificant increase above normal 27 days after the burn. The authors concluded that delayed death after the type of thermal injury employed is not due to persistent or recurrent shock.

JOHN H. MOHARDT, M.D.

*The Pathogenesis of Diastolic Hypertension.* PETER HILZBECKER. *Surgery* 1948 33: 618.

A concept of the pathogenesis of diastolic hypertension which has evolved from an understanding of kidney homeostasis and from studies of patients with Cushing's syndrome is presented. There is an extensive review of experimental evidence, chiefly in the dog, which is pertinent to the problem. Denervation of the neural hypophysis in the dog results in a preponderance and overaction of eosinophile cells in the glandular hypophysis. With marked depression of the secretion of the neural hypophysis a normal cardiac output is maintained and a moderate elevation of the mean arterial pressure develops. These changes also occur when the nervous pathways from the thalamus and subthalamus to the paraventricular and supraoptic nuclei are interrupted, when asphyxia in one adrenal gland is produced by ligation of a portion of its arterial supply when a diminution in the amount of effective renal tubular tissue is produced by removal of one kidney with the wrapping of the remaining kidney in silk, when mulberry-like ovaries are produced by prolonged administration of thionation their common factor of eosinophile overaction is considered to be significant as a causative factor in the development of hypertension.

These eosinophile cells are trophic to the adrenal gland renal tubules and to the interstitial tissue of the gonads. Loss or depression of the secretion of the neural hypophysis results in sensitization of the blood vessels to epinephrine, desoxycorticosterone and to renin. Under certain conditions of depression of the neural hypophysis there is increased output of the last two of these hormones the blood vessels are sensitized and hypertension results.

In certain cases of Cushing's syndrome an overaction of the eosinophile cells may result. The effects of hypertension and arteriosclerosis invariably produced are considered to result from a narrowing of the extrarenal blood vessels and of the efferent glomerular arterioles. Renin is released as a result of the latter action. It is to the combined action of these hormones in persons whose neural hypophysis is depressed and whose blood vessels are therefore sensitized to the constrictive action of these hormones that hypertension is attributed. There may be a constitutional susceptibility in addition.

The development of arteriosclerosis in addition to the overaction of the eosinophile cell adrenocortical hormone syndrome which results in the increased formation and storage of neutral fat and cholesterol.

The reaction of the body to any inadequacy in renal tubular function is regarded as resulting in hypertension. Renin is regarded as the substance released by the kidney tubules, which not only constricts vessels outside of the kidney directly, but also stimulates the eosinophile cells and thereby increases the cardiac output and renal tubular function. In combination with the desoxycorticosterone fraction of the adrenocortical hormone it leads to extrarenal vascular constriction.

The depression of the neural hypophysis in persons with essential hypertension is regarded first as functional because of nervous influences, particularly from the frontal lobes later in the malignant phase it may be organic as well because the increased intraventricular pressure acts on cells of the supraoptic and paraventricular nuclei.

Constitutional susceptibility of the nervous system to the depression of the hypothalamic nuclei and of the blood vessels to the constricting action of the hormones responsible for the extrarenal vasoconstriction is postulated for essential hypertension.

Inactivation of the secretion of the neural hypophysis by progesterone is regarded as resulting in the eosinophile cell preponderance in pregnancy. This stimulates the adrenal glands and in those persons who are emotionally and constitutionally susceptible it would be expected to result in sufficient constriction of the efferent glomerular arterioles to release renin. As in essential hypertension the combined action of these hormones together with the action of progesterone on vessels sensitized by the depression of the neural hypophysis, is regarded as primarily responsible for the initiation of diastolic hypertension.

The accepted importance of emotional influences in the development of essential hypertension is regarded as support of the concept of its pathogenesis as described by the author. The frequent association of obesity of premature ageing of decreased insulin sensitivity and of increased intracranial pressure particularly in later stages of essential hypertension is considered to support the probability of the hypothesis presented. Additional support is interpreted as being derived from the fact that the characteristics of the circulation of essential hypertension are similar to those which exist in the hypertension associated with Cushing's syndrome in which such a mechanism has been established. In essential hypertension the sympathetic nervous system and epinephrine are believed to produce rapid homeostatic adjustments of the renal circulation but they are not considered of primary importance in the pathogenesis of such hypertension. The author believes that his concept affords a mechanism for explaining the prevalence earlier and wider incidence of hypertension and arteriosclerosis in response to the stress and strain of modern existence.

The interested reader is advised to read the article in detail for the comprehensive review of the pertinent experimental evidence in support of the author's concept as well as the interesting diagrams illustrating



ing interrelationships which may exist between the many factors playing a part in the pathogenesis of hypertension

ALLAN D. CALLOW, M.D.

**The Effects of Shock on the Kidney** DONALD D. VAN SLYKE, *Ann. Int. M.* 94, 18, 70

Present concepts concerning the effects of shock on the kidneys have developed from the studies of many investigators. During World War II Bywaters and his collaborators reported on the effects of crush and compression injuries with uremic death in a series of cases following burial or pinning beneath falling debris in air raid casualties.

The author outlines the experimental and clinical studies of importance concerning the effects of shock on the kidneys and contributes the results of new experiments on kidney function and pathology initiated by a decreased volume of the circulating blood.

The type of shock here discussed is the condition caused by hemorrhage, burns, trauma, dehydration, or other injury in which there is an inadequate volume of blood to fill the vascular bed. However, the present discussion is limited to conditions of shock in which the decreased volume of circulating blood is due to blood or plasma loss or from dehydration.

The immediate and late effects of shock on the kidneys, based on available data, permit the following conclusions. The immediate effects of shock on the kidneys are circulatory. Renal blood flow is diminished and with it renal excretory function. The decrease may be so great that complete anuria results. However if the renal ischemia is not too complete or prolonged the kidney cells are not irreversibly injured, and restoration of a normal general circulation is followed by recovery and normal renal function within a short time. The initial shutdown of the renal circulation appears to be a part of a defense reaction of the organism to loss of circulating blood volume; the vascular bed is contracted by peripheral constriction so that the diminished volume of available blood will be adequate to supply the vital organs such as the brain, the function of which must be maintained to avoid immediate death.

If shock is severe and prolonged restoration of the general circulation and recovery from the circulatory symptoms of shock may not be accompanied by resumption of normal renal excretion. Anuria or oliguria may persist, or urine of low specific gravity may be excreted. This period of complete or partial renal failure may last until fatal uremia develops in a period that may vary from 2 to 30 days, or gradual return of function may occur so that the excretion becomes sufficiently restored to prevent uremia, and ultimately recovery of the kidneys may be complete.

Shock must be severe and prolonged to cause irreversible changes in the kidneys, but if it is too severe it causes death from circulatory failure before the patient has had time to develop uremia. The inability to stop the progress of uremia of severe or prolonged shock was a major concern to surgeons in the late war. Renal failure persisting after shock is due to organic injury initiated during shock by ischemia.

Histologic studies by Bywaters and his colleagues (Lucke, Mallory and others) have revealed severe damage to the renal tubules, mainly the distal tubules and loops of Henle, with little or no glomerular damage, as a constant finding in postshock uremia. The presence of hemoglobin derivatives which formed in the tubules one or more days after onset of renal failure was also noted; this may contribute to the progress of tubular damage initiated by ischemia. The tubular lesions suggest that the cause of post shock uremia may be not the failure of glomerular filtration but the tubular reabsorption of glomerular filtrate and its excretory constituents.

To diminish the danger of death from postshock uremia, the following procedure is emphasized: (1) cut the duration of shock as short as possible by quick restoration of the blood volume through adequate replacement of the lost blood with plasma or saline solution; (2) if acidosis is present, either during or after shock administer adequate amounts of bicarbonate of soda; (3) while the administration of large amounts of fluid may be necessary to obtain normal blood volume and hydration, over-administration is to be avoided both during and after shock as circulatory embarrassment may be caused. The measuring of the specific gravities of blood and plasma, preferably by the copper sulfate method, is of practical assistance in planning and guiding fluid administration; (4) when after recovery from acute shock anuria or excretion of urine of low volume and specific gravity persists and the blood urea continues to increase a diet high in carbohydrates and fat, and low in protein should be prescribed to retard accumulation of catabolic products; and (5) it appears that vividification and peritoneal and gastrointestinal irrigation may overcome the uremia and favor recovery of the renal function. JOHN H. MOWATT, M.D.

**Hemangiomas: an Evaluation of Treatment by Injection and Surgery** NEAL OWICKS and KATHLEEN L. STEPHENSON, *Plast. Reconst. Surg.* 1948, 3, 99

Hemangiomas generally pursue a benign course but if untreated, frequently grow more rapidly than commonly suspected, and thus produce cosmetic deformities. Occasionally there may be rapid acceleration with destruction of an important anatomic part such as the eye, nose, ear, lip, cheek, neck, or a large portion of the skin of the scalp, neck, back, and extremity may become involved. Ulceration and secondary sepsis may become the problem. When rapid growth takes place as in the aggressive hypertrophic type, it is fundamental immediately to consider surgical excision in order to avoid further destruction, unless one elects injection therapy. Establishment of a positive diagnosis by biopsy is one excellent reason to elect surgical excision in contrast to injection. Rarely one may encounter a case which on biopsy may appear benign histologically but which, as subsequent history discloses, is malignant due to metastasis. Occasionally the growth may become diffuse and involve an entire extremity or establish connection with a large blood vessel and become destructive.

tive or dangerous because of severe hemorrhage. In many instances the apparently discrete areas may be deceptive in that their extension can be remote to the area defined by the slightly raised red tumor.

The female is affected two to three times as often as the male. Although no acceptable explanation for this higher female incidence has ever been offered, Watson and McCarthy have suggested that the hemangiomata may in some fashion be related to the female sex hormone and in this connection it is of interest to note that a hemangioma may start or increase rapidly in size with the onset of the menses or at the beginning of pregnancy.

It is generally accepted that hemangiomas are tumors of independently growing blood channels with their origin in embryonic rudiments of mesodermal tissue. The vascular channels, their arrangement and the amount and character of the surrounding stroma are the most logical basis for classification. Angiomas may develop in capillaries and exhibit a capillary structure. Or they may be composed of large lacunae usually with venous connections (rarely arterial) surrounded by very little stroma.

Rarely there are certain of these tumors that are microscopically similar to the ordinary benign capillary or cavernous hemangioma and yet metastasize. When they involve the internal organs extensively they are the cause of death of the patient and thus are malignant. This group is not well defined. Much confusion has arisen in this regard and there are few authentic cases on record.

For the purpose of classification the following chart based on Foot's classification is presented:

Capillary hemangioma	{ (minimal supporting stroma)
Cavernous hemangioma	
Melanizing hemangioma (cavernous or capillary)	{ (periendothelial hyperplasia)
Sclerosing fibrous hemangioma	
Hemangioendothelioma	{ (aberrant pleomorphic vessels with complete supporting stroma)
Angiosarcoma	
Arterial hemangioma	
Cavernous hemangioma	

In the treatment of hemangioma the authors have limited themselves to the use of surgical excision and the injection of sodium morrhuate. In almost all types of hemangioma injection therapy is indicated and surgical excision is to be selected when there is evidence of infection or if hemorrhage malignant degeneration or carcinoma is present. Injection therapy is a particularly important method in those cases in which surgical excision to effect a cure would be unfeasible, as in a part such as a nose, ear lip, or perhaps the extermination of an orbit. In these cases a cure resulting from sodium morrhuate injections effects the desired cosmetic results with the advantage of having the patient free of the tumor.

Half a century ago a large collection with illustrations by Evans of one operation after another through the long period of time in the treatment of hemangioma of the face and neck area is a just therapeutic means for the treatment

the office over a period of months. The decision should not be made without careful consideration of the tumor location, the availability of tissue for repair, ease of surgical excision and the possibility of complete eradication by one surgical maneuver.

LOUIS T. BAKER, M.D.

# Cancer Mortality in Egypt MAHMOUD AHMED ARIFF Cancer Res. 1948 7: 537

The reported cancer mortality rate in Egypt in 1942 was 27.2 per 100,000 inhabitants or roughly a fourth of that in the United States and a seventh of that in England and Wales. This is in marked contrast to the death rate from all causes which is about three times that of the United States or England and Wales. In this article the author discusses the shortcomings of the information on which the cancer mortality rate is based. Only a third of the population of Egypt lives within the area where deaths are formally registered. Only half of the death certificates filed for this area list a cause of death. In the majority of instances in which a cause of death has been listed there has been no opportunity to ascertain the diagnostic accuracy of the certificate. The author believes that many deaths from cancer may have been listed under some other cause.

Analysis of data for the 12 year period from 1931 through 1942 show that the most frequent site of fatal cancer was the male genital organs with 1,451 deaths out of the total of 12,606. Malignancy of stomach and duodenum accounted for 1,337 deaths. The next two most common sites of fatal cancer were breast and uterus with 1,220 and 1,216 deaths respectively for these organs. Although the breakdown of the whole group of cancer deaths by sex, age, race and religion as well as by the section of the country from which the death was reported seems to show very significant differences, the author is inclined to attribute many of these differences to poor reporting and certification of death.

There has apparently been no occupational cancer in Egypt nor has there been any cancer resulting from radiotherapy. However there has been a high incidence of cancer in conjunction with bilharzias especially that of the bladder. Since this disease affects from 30 to 60 per cent of the population of Egypt it is difficult to evaluate the causal relationship between it and cancer. Indeed the author doubts whether there is a causal relationship.

BENJAMIN F. LOEWENBERG, M.D.

## DUCTLESS GLANDS

Interpretation of Estrogenic Therapy of Cancer of the Breast (and Prostatic Glands). The Elective Effect of Estrogens on Mesenchyma and Its Importance (Interpretazione della terapia estrogenica del cancro della mammella [e della prostata]). Atene clinica degli estrogeni sul mesenchima e sui linfociti e sulla prostata. C. SERRA and R. CERRA. *Atene Clinica* 1947 33: 319.

If the results of studies of cancers of the breast favorably influenced by estrogenic therapy did not dem-

onstrate regressive alterations in tumor cells but showed a substitution of connective sclerotic tissue by one rich in blood vessels, fibrillae and histiocytic formations.

The hard consistency of tumors and their fixations are caused according to the authors, by the character of the stroma rather than that of the neoplastic cells.

Modifications of the stroma caused by the estrogenic therapy are responsible for the reduction of the size of the tumor its increased mobility the ceasing of pains, and recurrence of canalization such as may be observed in carcinomas of the prostate gland.

Observations on patients and experimental studies revealed to the authors the elective hyperplasiogenic effect of estrogens on the mesenchyma.

The observations were made on a young women, 2 women in the menopause and 2 men. Fibroadenomas and biopsies of the skin were studied in patients who underwent the treatment with estrogens and in control persons.

The stimulation of the mesenchyma by estrogens is more intensive whenever an abnormal activity of the tissues, caused by ulcers or foreign bodies, is present

The effect of estrogen on cancer of the breast is different in women during active sexual life from that in women in the menopause. In the first group a large number of fibrillae develops and the connective tissue appears soft, while in older women a fibrous, hard stroma much poorer in cells results from estrogenic therapy  
JOSEPH K. NARAY, M.D.

The Neuroendocrine Regulation of the Intestinal Absorption of Glucides (La régulation neuro-endocrinienne de l'absorption intestinale des glucides).  
ANDRÉ SOULAIROL. *Ann endocr. Par.*, 94) 8: 377

The author has completed an experimental study in the rat on the action of the endocrine glands and certain nervous mechanisms in the regulation of the intestinal absorption of glucose and glucides.

Experimental evidence would suggest that such absorption is controlled by hormonal activity of the islets of Langerhans the thyroid, the adrenal and the hypophysis. From the work presented it would seem that the action of these hormones is in turn dependent upon a hypophyseal-hypothalamic synergistic regulatory center.

This concept bears further investigation and may cast much light on certain nutritional problems and diabetic states.  
EDWARD W. GIBBS, M.D.

### THE PATTERN OF VASOSPASM FOLLOWING ACUTE ARTERIAL AND VENOUS OCCLUSIONS

#### A Micrometric Study

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THE present study is concerned with the micrometric measurement of changes in caliber of the smaller radicals of the mesenteric vascular tree following occlusion of the superior mesenteric vessels. Our interest in the problem of vasospasm following vascular occlusions arose while studying the response of mesenteric vessels to intestinal strangulations (23). We were impressed by the importance of residual vasospasm in the involved vasculature following release of the strangulations at operation. Such vasospasm apparently had a marked influence on the recoverability of strangulated bowel. The study also showed that regardless of whether the strangulations were primarily venous or arterial vasodilating measures were of great value in resuscitation. From a review of the literature on the pathological physiology of peripheral vascular occlusion it appears that the mesenteric vessels behave no differently than the branches of mainstem vessels in other parts of the body following occlusions (2). Therefore our studies which were undertaken primarily to investigate the importance of vasospasm in intestinal strangulations have led us into much broader fields. The implications of our findings might

find application in the nature of most other vascular occlusions.

#### TECHNIQUE

Through the generosity and co-operation of Dr. M. H. Kniseley and his associates of the Department of Anatomy of the University of Chicago we were able to utilize a modification of the Kniseley fused quartz rod transillumination apparatus (18, 19). The main features of this apparatus are the employment of a cold light source and a constant temperature bath with variable volume flow. The apparatus was constructed essentially as shown in Figures 1, 2, and 3. A Leitz micrometer lens was installed in the microscope lens system. Young small dogs were used in all experiments and intravenous nembutal anesthesia.

A special lucite tray was constructed to hold the dog's mesentery in a nonstretched position submerged in constantly circulating mammalian Ringer's solution at body temperature. The tray as shown in Figure 4 was built with a lower compartment through which water circulated. This lower layer served to disperse the quartz light after it emerged from the end of the quartz rod in order to do away with the theoretical consideration that even cold light will produce warmth at the point of contact with the tissue.

From the Department of Surgery, Northwestern University Medical School, Chicago.

The microscope was fixed on small vessels in the mesentery a small vein and artery run side by side as a rule. Such a field gave us a very satisfactory view of both the arterial and venous responses. Precapillary vessels the artery measuring from 0.54 to 1.44 millimeter the vein from 0.90 to 2.88 millimeter were chosen rather than the more minute vessels or capillaries since more accurate changes in caliber could be measured at 48 diameters. The capillary bed varies from one field to another such an extent that the information derived from viewing capillary vessels alone is not always pertinent. Furthermore the reaction of the capillaries does not always parallel that of the slightly larger vessels.

Six control animals allowed to remain in the apparatus for from 4 to 8 hours showed no appreciable changes in caliber in the observed vessels. Thus any marked changes which occurred in subsequent experimental animals were considered dependable as a response to the lesion produced.

#### VENOUS OCCLUSIONS

In 40 animals the superior mesenteric vein was clamped with a rubber tipped artery forceps for periods ranging from 30 minutes to 2 hours 29 minutes. In order to obviate the possibility that the superior mesenteric artery might be stimulated into spasm by operative trauma the procedure was carried out in the following manner. The vein was carefully isolated and a loop of stout string placed loosely about it. The intestines were then returned to the abdomen and the abdominal wall closed temporarily by clamps. The animal was allowed to remain in this condition for periods up to an hour. The mesentery was then gently placed on the lucite tray and submerged in Ringer's solution. A control series of readings was taken to make sure that no undue changes in caliber resulted from the operative manipulation. The loop placed about the superior mesenteric vein was then drawn up and a rubber tipped artery forceps placed on the vessel. It was allowed to remain in place for varying periods of time while measurements were made on the vessels in the microscopic field. The clamp could be removed without reopening the abdomen.

The pattern of response in the observed vessels was remarkably uniform. In each of the few instances of failure to observe the usual responses the failure was due either to an overzealous dissection of the vessel from its fatty bed or to the presence of one or more accessory vessels which carried enough blood to make the occlusion incomplete. Upon ligation of these vessels the occlusion of the main stem produced the same responses in the smaller vessels as were seen in all other animals.

Following venous occlusion there was invariably a marked spasm (decrease in caliber) of the small artery and a gradual dilatation of the concomitant vein. In some instances of venous occlusion the artery diminished to  $\frac{1}{3}$  its original caliber. In 7 dogs the clamp was allowed to remain in place until death of the animal. Most of these animals died in shock within 3 hours. Plasma and blood loss from the mesenteric and intestinal vessels is responsible for this shock. In 33 dogs the clamp was released after a period of occlusion, and measurements were made up to 2 hours following release.

In the animals with venous occlusion persisting until death the artery after a period of marked spasm sometimes relaxed slightly just before death, other times a state of spasm persisted. The latter usually occurred when a thrombus formed in the artery. However only rarely did this terminal loss of tone result in a diameter as large as the control. In other words the arteries were still slightly narrower than the preocclusion caliber during shock and at the time of death despite slight secondary relaxation. The concomitant vein after a period of dilatation usually became slightly narrower just before death. Occasionally it became even narrower than the preocclusion caliber.

Usually within 30 minutes of a venous occlusion the flow of blood in the vein slowed down until the stream was barely moving. At this stage there was still a rather rapid flow in the spastic artery. Groups of cells within the

It is known that the sympathetic nerves of the mesentery follow the course of the main blood vessels. Therefore, stripping the main stem mesenteric vessel of nerves eradicates sympathetic responses in the mesenteric vascular tree. If the extremities however the sympathetic nerves reach the esentary segmental manner making perivascular sympathectomy an incomplete procedure.

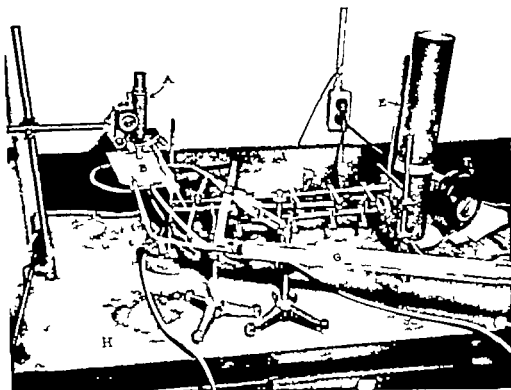


Fig. 1. Detail of fused quartz rod transillumination apparatus. Microscope (A) Double layer lucite tray (B) Spray for Ringer's solution (C) Kniseley quartz rod apparatus (D) Metal shield (E) containing 200 watt projector type bulb. Air blower (F) mounted on sponge rubber. Condenser (G) has inner jacket containing Ringer's solution feeding into upper chamber of lucite tray and outer jacket containing water leading into lower chamber of tray. Steel tray (H) mounted on sponge rubber with drain hole in left lower corner.

artery were seen to agglutinate and travel in clumps. In a few instances the artery narrowed down to allow only a single file of cells through it. In such cases the clumps usually traveled in spurts being caught momentarily here and there on the wall of the artery. We were impressed with the possibility that such clumps can conceivably be the source of local propagating thrombi or distant emboli. The early stage of such clumping has been termed "sludge" by Kniseley (20). Kniseley and co-workers found that sludge forms in many diseases as well as in traumatic shock. Because the venous stream is so slow at this stage the clumping within the vein cannot be recognized as readily, but just before the venous flow ceases it becomes quite apparent from the irregular outline of the slowly moving stream that agglutination has occurred. At first this is only a microscopic agglutination, since cutting such a vein at this time will result in the free flow of blood from the lumen.

The behavior of the capillaries during venous occlusion does not necessarily follow

that of the vessels described above. Almost immediately after the vein is occluded the capillaries become greatly dilated. Within 5 to 10 minutes of a venous occlusion of the mesentery small ecchymotic hemorrhages occur due to overstretching and rupture of the capillary walls. This reaction of the capillaries to venous occlusion is by no means uniform. Some fields of the same mesentery exhibit such marked constriction that the capillaries are almost indiscernible. Sludge forms in the capillaries within a few minutes after venous occlusion. The difference in reaction between the precapillary vessels and the capillaries agrees with the observations of several other investigators made during experiments with widely divergent purposes (21).

After the clamp is removed from the main vein the small arteries remain in a spastic condition for varying periods of time. This residual spasm following the release of a venous occlusion apparently plays an important role in the question of viability in strangulated intestine (23). The duration of the

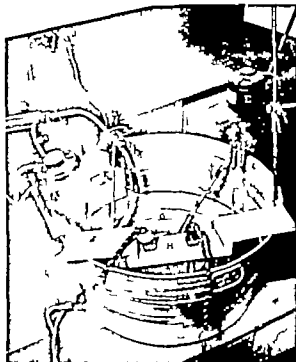


Fig. 1. Detail of water bath. Pump (A) for pumping water heated to 4 degrees C into outer jacket of condenser (B). Bimetallic thermometer (D). Relay (C). Wash tub (F) serves as water bath. Lead coil (G) carries Ringer solution supplied through tube (J) for warming water bath. Heating unit in inner jacket of condenser (E). Motor (E) for spinning mixing rod to stir the water in bath. Two heating electrodes in wooden holder (H). Thermometer (K) dips into water bath.

The pattern of behavior of the smaller radicals following venous main-stem occlusion can be summarized as a moderate dilatation of the veins and marked spasm of the arteries. Following release of the occlusion the vein soon returns to its normal caliber while the artery persists in a state of residual vasospasm for varying periods of time. The capillary vessels do not follow the pattern of the precapillary artery or the postcapillary vein. Capillary behavior in general following venous occlusion is one of marked dilatation but certain areas of the capillary bed are in marked spasm at the same time.

#### ARTERIAL OCCLUSIONS

The same technique was used for occlusion of the superior mesenteric artery in 21 dogs as was used in the case of the vein. The clamp was allowed to remain on the artery for periods ranging from 5 minutes to 2 hours.

The pattern of response of the observed vessels was again rather constant. The difference between animals was only one of degree. In each instance the small arteries responded by a marked spasm. In most animals the concomitant vein also went into a moderate degree of spasm following arterial occlusion. The gut became very white contracted and exhibited the typical nipped appearance of superior mesenteric artery occlusion.

Upon release of the clamp from the artery the bowel flushed with reactive hyperemia. The interesting feature of this period of reactive hyperemia is that the small artery under observation maintained a definite degree of residual spasm while the capillaries became markedly dilated. This was a disturbing observation since all previous studies (12-30) on reactive hyperemia employing such indirect measurements as blood flow temperature etc. indicate that the flow during reactive hyperemia is increased. Since most studies on reactive hyperemia (12) were carried out with short term (5 and 10 minute) occlusions we ran a series of 7 short term occlusions. Our findings were no different than in the longer periods of ischemia. The small arteries maintained a definite state of spasm in the face of gross flushing of the tissues upon

arterial vasospasm following venous occlusion varies considerably from one animal to another but apparently has some relation to the duration of the original occlusion. For example in one animal (Dog No. 9) with a venous occlusion of 20 minutes the artery regained its original caliber 15 minutes after the clamp was released. In another animal (Dog No. 14) with a venous occlusion lasting 27 minutes the residual spasm persisted for 25 minutes. In another instance (Dog No. 11) the ligation lasted for 1 hour and residual spasm in the small arteries was present until the death of the animal almost 2 hours after release of the clamp. Although in an occasional animal the residual arteriospasm was very short lived and bore little relation to the duration of the occlusion there was some residual vasospasm in every instance of complete occlusion.

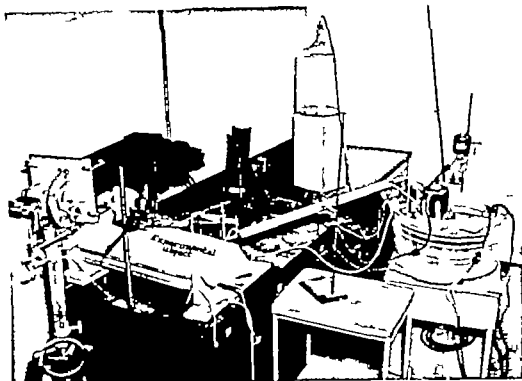


Fig. 3. View of complete setup with camera in place for taking photomicrographs or motion pictures.

release of the occlusion in all but 1 instance. In this 1 case the caliber of the artery reached the preocclusion caliber but did not exceed this diameter at any time during reactive hyperemia.

Following arterial occlusion the blood in the artery slows markedly and stops within about 10 minutes. The blood in the vein runs a rather parallel course. Clumping of cells within the vessels occurs as the stream slows down in both the narrowed artery and the narrowed vein. Thus we observed the mechanism of segmental venous thrombosis in arterial occlusions.

Upon release of the clamp the artery does not usually regain its original caliber for a considerable period of time. For example, when the superior mesenteric artery was clamped for 1 hour (Dog No. 22) the residual arterial spasm following the release of the clamp lasted until the death of the animal 1 hour and 30 minutes later. However the same relationship between the duration of occlusion and residual vasospasm does not seem to hold as it does in most cases of venous occlusion. Thus in another case of arterial occlusion (Dog No. 23) the artery was

clamped for 1 hour and 10 minutes, but it regained its original caliber within 15 minutes after release of the clamp. An interesting observation was the fact that in some instances of long term arterial occlusion the dogs died in a state of shock within 3 hours after the release of the arterial occlusion and the maintenance of spasm may have been an expression of shock in such cases. There was an obvious loss of blood and plasma through the capillary walls sufficient to account for shock.

In summarizing the pattern of behavior of the smaller vessels following arterial occlusion it can be said that both the artery and vein respond by a marked degree of spasm. The reactive hyperemia following release of an arterial occlusion is not reflected in the caliber of the small arteries. On the contrary the small arteries may actually be in a state of spasm while the tissues grossly are more red than normal. This would indicate that the increased blood flow in the larger vessels, as reported by others and the dilatation of the capillaries during the period of reactive hyperemia are compensated for in part by spasm in the precapillary arterial bed. This is apparently protective in nature. Abramson has termed



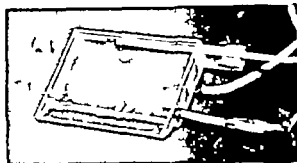


Fig. 4 a, also Detail of double layer lucid tray. Upper chamber holds mesentery submerged in circulating mammalian Ringer solution. Thermometer indicates temperature of Ringer solution. Water circulates through lower chambers. Inlets on one side or outlets on the other. b, Detail of mesentery in place on lucid tray. Intestine held in on tray bed position.

the arterioles the stopcocks of the capillary vessel. Thus large vessels, small vessels and capillaries may each behave differently in response to a given lesion.

#### STRANGULATION OCCLUSIONS

Having established a fairly definite pattern of response in the small vessels following main stem vascular occlusions in the mesenteric vessels, we were interested in whether the more peripheral occlusions, such as occurred in strangulations would give similar responses. Consequently in 12 dogs venous type strangulations were made with binding tape involving an intestinal loop of sufficient length to give us a satisfactory microscopic view of the involved portion of the mesentery. This was usually some 15 or 18 inches of bowel. Because of the very nature of this type of occlusion it was not possible to duplicate exactly the same lesion in each animal. Nonetheless our findings were rather constant.

Vasospasm distal to the occlusion followed most strangulations but differed somewhat in character from that following main stem occlusions. In the strangulations vasospasm was not as severe and developed more slowly while thrombosis developed more rapidly than in the main-stem occlusions. The thrombosis usually followed very closely the first signs of vasospasm. In 3 instances thrombosis actually occurred in some vessels before spasm became evident in others. In such cases the larger patent vessels decreased in caliber

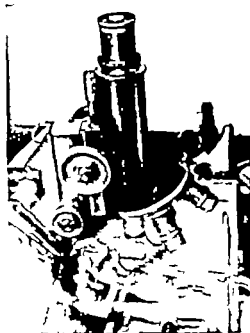


Fig. 4. b.

Upon release of the strangulation residual vasospasm was observed in the still patent small arteries. Once thrombosis of a vessel was complete the vessel reacted no longer whether the bowel regained viability or not.

#### DISCUSSION

In measuring the responses of small vessels to occlusive lesions by means of direct micrometry we have uncovered certain behavior patterns which until now have not been measured by direct observation. Certain features however have been known for some time. For example arterial vasospasm following venous occlusion was first reported in a clinical study by Trémolières and Vêran in 1929, in which these authors described a case of arterial obliteration in the leg occurring in the course of thrombophlebitis. Following this report a number of similar articles appeared in the French (4, 5, 6, 13, 15, 16, 40), Italian (39, 44) and German (24, 25) literature. In some instances of thrombophlebitis the vasospasm was so marked that the condition was originally considered to be one of arterial embolism and actual gangrene has been known to occur (7, 42). However the mechanism was not well understood. In 1934,



Fig. 5 Venous occlusion. A Control appearance of vein (left) and artery. B After 45 minutes venous main-stem occlusion, artery is narrower and vein is wider than control. Note petechiae from capillary in upper portion of photograph. Magnification  $\times 25$ .

Lancke and Kunlin (28) postulated the existence of an inflammatory exudate about the area of thrombophlebitis which they claimed threw the adjacent artery into contraction, and this in turn set up a peripheral vasoconstriction. The process was clarified by the experimental work of DeBakey, Burch and Ochsner reported in 1930. These authors found that chemical femoriliac thrombophlebitis produced a marked diminution in the volume of peripheral pulsations in the dog.

Interruption of the nerve pathways by lumbar sympathectomy abolished this effect. This indicated that vasoconstrictor impulses arose in the thrombotic vein and were transmitted to the arteries by way of the ganglia. These authors also demonstrated a diminution in pulsations following simple ligation of the main vein, making it unnecessary to implicate an inflammatory exudate as the irritant in the acute stage. By injecting irritating chemicals about the artery, they showed that the same



Fig. 6 Venous occlusion with a latex clot. A Control appearance of vein (left) and artery. B After 15 minutes latex occlusion, vein is dilated. C Ten minutes after release of venous occlusion, some residual parasympathetic activity. Magnification  $\times 25$ .



Fig. 1. Arterial ligation. A. Control specimen showing normal arterial flow. B. Specimen after ligation of the artery. C. Specimen after ligation of the vein. D. Specimen after ligation of the lymphatics. E. Specimen after ligation of the lymphatics and the artery. F. Specimen after ligation of the lymphatics and the vein. G. Specimen after ligation of the lymphatics and the artery and the vein. H. Specimen after ligation of the lymphatics and the artery and the vein and the lymphatics.

Fig. 2. Venous ligation. A. Control specimen showing normal venous flow. B. Specimen after ligation of the vein. C. Specimen after ligation of the artery. D. Specimen after ligation of the lymphatics. E. Specimen after ligation of the lymphatics and the artery. F. Specimen after ligation of the lymphatics and the vein. G. Specimen after ligation of the lymphatics and the artery and the vein. H. Specimen after ligation of the lymphatics and the artery and the vein and the lymphatics.

pattern to an exaggerated degree occur once an exudate is present. Our experiment on venous occlusion confirm those of DeBakey, Burch, and Ochner.

Leriche's main contribution in this field was his contention that the edema following venous obstruction is largely due to peripheral vasospasm and his discovery that sympathetic procaine block relieves the edema (26, 27, 29). McMaster and Larson in 1918 substantiated this point of view by showing that in the absence of arteriolar pulsations the lymph flow was slow while in the presence of pulsations the flow was rapid. Ochner and DeBakey (38) in 1930 emphasized the vasospastic element in venous occlusive disease and popularized Leriche's work by recommending sympathetic procaine block for the relief of edema following thrombophlebitis.

Our studies have uncovered an additional feature of this pattern which appears to have

an important bearing on the reversibility of strangulated intestine and may also be of consequence in other occlusive lesions. This consists of a state of vasospasm which remains after release of the occlusion. We have termed this phenomenon *residual vasospasm*. It has been shown in this laboratory (21) that residual arterial vasospasm following release of a venous strangulation of the intestine may prevent recovery of an otherwise viable intestinal loop.

We found that spasm resulting from a main stem occlusion be it arterial or venous depends primarily upon the completeness of the occlusion. Whenever the expected reactions in the small vessel district occur this was due either to destruction of the nerve filaments about the vein by dissection or to an accessory vessel arising just proximal to the clamp. If these accessory vessels were ligated and the clamp reapplied in the same place the usual

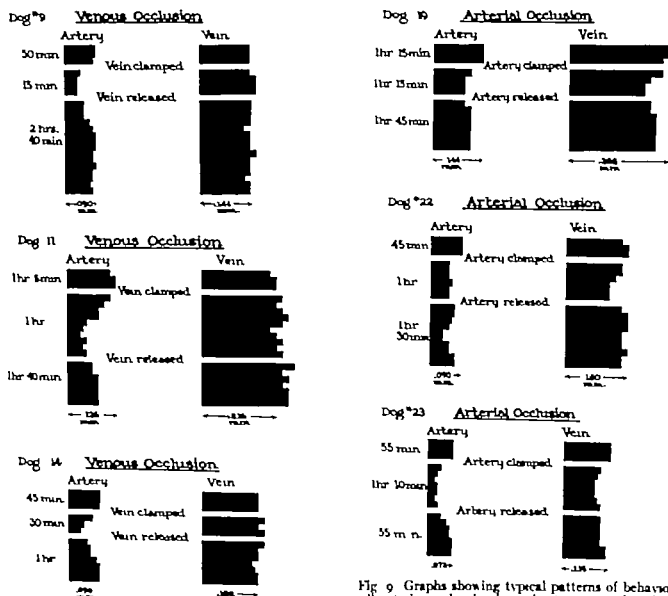


Fig 8. Graphs showing typical patterns of behavior of small arteries and veins in main-stem venous occlusion. During venous occlusion there is spasm of the artery and moderate dilatation of the vein with residual arterial spasm after release of the occlusion.

Fig 9. Graphs showing typical patterns of behavior of small arteries and veins in main-stem arterial occlusion. During arterial occlusion there is spasm of the artery and vein with residual spasm following release of the occlusion even in the presence of gross reactive hyperemia.

pattern of vasospastic responses occurred. Though the degree of spasm was not always the same, the pattern was fairly constant.

On this basis, it may be possible to explain the inconsistent clinical reports regarding the temperature of an extremity following venous thrombosis (1). If the occlusion in the main stem vein is complete from the beginning, the arterial spasm will be severe and the limb will be cold. If the thrombosis occurs in a section of the vessel allowing for partial venous circulation, the arterial spasm may be inconsequential or absent, in which case the limb will be warm. Such a limb may be even warmer

than normal since there is no diminution in the arterial inflow and a partial obstruction to the outflow. Thus, as far as we can postulate from our experiments, one of the crucial issues is the position of the occlusion in the vessel in relation to accessory branches.

We found further that capillary responses do not necessarily parallel those of the artery or vein. The small artery remains in a state of spasm long after the capillaries have become widely dilated. In venous occlusions, the capillaries are dilated by distention, though not uniformly so. In arterial occlusions, the capillaries contract severely but eventually relax due to anoxia. Even after this type of relaxation, the small arteries remain spastic.

Spasm of the small branches of an occluded artery has been described many times in the literature (8 11 31 32 35 41). Our observations not only confirmed the clinical findings reported by others but we found that residual spasm occurs in the small arteries in the presence of reactive hyperemia. Our explanation as stated rests on the fact that there is a difference in response under certain circumstances by each of the three portions of the vascular tree—the main stem the small vessel and the capillary.

Observations of the intravascular blood during the various stages of arterial occlusion have brought up certain speculations regarding the associated phenomena in clinical occlusive arterial disease. We have observed that venous spasm invariably accompanies arterial spasm in arterial occlusion. The streams in both the arterial and venous systems become retarded. Clump formation or the agglutination of erythrocytes occurs in both the arteries and veins. It would seem that here is an explanation for the thrombotic phenomenon so often seen in the venous system accompanying arterial occlusive disease. The segmental type of venous thrombosis which often is an integral part of Buerger's disease could thus be explained on the basis of clump formation in the smaller radicals of any given venous segment propagating to build a large thrombus which finally occludes the regional segment of a large vein.

In venous type strangulation occlusions we found that thrombosis played a more important role than in the main stem vascular occlusions. Spasm of the small artery occurred as it did in the main stem occlusions, but when the small vessel became occluded by a thrombus it no longer reacted. Residual spasm was observed upon release of the strangulation as previously reported (23). When thrombosis occurred during residual spasm the spasm remained whether the bowel regained viability or not.

We are now conducting experiments utilizing various therapeutic agents such as sympathetic nerve section and certain drugs in an attempt to observe directly the effects of such agents on the caliber of the small vessels and the state of the blood in the various stages

of occlusive lesions. These findings will be reported in another communication.

# CONCLUSIONS

1 Vasospasm generally accompanies main-stem vascular occlusions.

2 In venous occlusion there is a marked arterial spasm (decreased caliber) and a venous dilatation (increased caliber).

3 Following release of venous occlusions the artery remains in a state of moderate spasm for a considerable period of time. We have termed this phenomenon *residual spasm*.

4 In arterial occlusion there is a marked arterial spasm and a concomitant venous spasm.

5 Following release of arterial occlusions, grossly visible reactive hyperemia occurs but during this state the precapillary artery remains in spasm.

6 Sludge formation (Kniseley) is seen in the smaller vessels during both arterial and venous occlusions. Minute thrombi form easily in the spastic vein during arterial occlusion and may propagate thus accounting for segmental venous thrombosis in arterial occlusive disease. This observation makes it unnecessary to postulate the presence of per-arterial inflammation as a venous irritant in the production of venous thromboses.

7 Reactivity in a small vessel becomes arrested once the vessel is thrombosed.

8 The importance of vasospasm in the phenomena accompanying vascular occlusions in general is emphasized.

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# III USE OF THE MOE PLATE IN THE TREATMENT OF INTERTROCHANTERIC FRACTURES

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**O**pen reduction with internal fixation of intertrochanteric fractures of the femur has become an accepted procedure only within the past few years. As a rule this type of fracture will readily be so-called conservative meth-

ods of treatment. There is however a definite incidence of these fractures in elderly patients who are poor medical and surgical risks. This fact has tended to be overlooked in the large amount of literature occasioned by the use of the Smith-Petersen triflanged nail for fractures of the neck of the femur. It is the purpose of this paper to present the use of a new type of internal fixation apparatus called the Moe plate. This plate was devised by Dr John H. Moe of Minneapolis and to the best of our knowledge has not previously been described in the literature. During the past year the Moe plate has been used in the treatment of intertrochanteric fractures at the Boston City Hospital. Because of the highly satisfactory results obtained in this series of cases the following report is submitted.

In the past many methods of immobilization have been used to treat intertrochanteric fractures of the femur. These include abduction spica casts, well leg traction, Russell's traction, the Hodgen splint just to mention a few. But it has been pointed out by several (1, 8, 13, 22, 25, 26) that the complications which arise out of such treatment greatly increase morbidity and mortality in the aged. It is for these reasons that open reduction and internal fixation have been advocated for the treatment of this type of fracture (6, 9, 13, 22).

In favor of the operative therapy for intertrochanteric fractures it has been pointed out that the incidence of these fractures is high, varying from 47.8 (25) to 64 per cent (24) of hip fractures and Morris found them to be four times as frequent as fractures of the femoral neck. Thus these fractures account for a

considerable number of all hip fractures and are a serious problem in the older age groups. In addition in older age groups intertrochanteric fractures occur more often than those of the femoral neck. In several series (2, 10, 13, 14, 16, 17, 21, 23, 26) reported in the literature the average age of patients with intertrochanteric fractures is 70.39 years, whereas that of patients with femoral neck fractures is 65.1 years (13, 26).

Other factors which contribute to the greater severity of intertrochanteric fractures are the greater trauma usually responsible for this type of fracture with a greater degree of shock, more hemorrhage and more soft tissue damage than that which occurs with fractures of the femoral neck. As a result there is usually more severe pain and a greater deformity. Another factor which contributes to the greater shock and pain is the marked degree of comminution of fragments which often occurs in intertrochanteric fractures. This comminution as seen at the time of operation is frequently much greater than is apparent by x-ray examination.

Most of the conservative methods of treatment require prolonged periods of immobilization and bed rest. Such procedures involve a high incidence of hypostatic pneumonia, decubitus ulcers, joint stiffness, incontinence, mental deterioration, thrombophlebitis, muscular wasting and general debility. Early ambulation especially of the aged is currently much emphasized. Additionally there is a shortage of trained nurses. Hence a method by which nursing care can be reduced to a minimum and aged patients can be made ambulatory on crutches at an early period in their illness is much to be desired. This can be accomplished by open reduction and internal fixation of these fractures.

It has been shown (6, 9, 21, 22) that open reduction leads to freedom from pain almost

immediately after operation. Early crutch ambulation is possible; the patient is allowed more freedom in bed, and there is a reduction in the total amount of hospitalization. Joint stiffness, limb atrophy, and bed sores are minimal or absent. Chiefly, there is a decrease in mortality and morbidity. In the past 8 years, several methods of internal fixation for intertrochanteric fractures have been reported (3, 6, 7, 8, 9, 10, 11, 13, 15, 16, 17, 18, 20, 22, 25, 27, 28), all with similar results in general, and it is beyond the scope of this paper to report these methods.

In order to maintain reduction of an intertrochanteric fracture, it is necessary to immobilize not only the fracture site but also the proximal and distal fragments. Because the neck of the femur makes an average angle of 127 degrees with the shaft, any form of fixation which transfixes only the fracture site is not sufficient in most cases to overcome the muscle pull and prevent a coxa vara deformity. This difficulty is met in most devices by a plate which attaches to the upper end of the femoral shaft. It is incorporated into the mechanism immobilizing the fracture site so as to counteract the muscle pull and to prevent the deformity. In some devices this is accomplished by a single piece (3, 8, 11, 15, 16, 17); in others by a combination of devices (7, 9, 18, 22, 25, 27, 28). The Moe plate, which is the subject of this report, is a single plate bent to fit over the greater trochanter in its proximal portion and prolonged into a plate to fit the femoral shaft in its distal portion (Fig. 1).

The Moe plate is constructed of stainless steel of the SMO 18-8 group and has the shape of a question mark; the curved portion being that portion which is molded to fit over the greater trochanter. The plate has been placed against the femur in several skeletons and has been found to fit without any change being necessary. The size of the plate is determined largely by the straight prolongation which fits over the shaft of the femur and which is drilled to accommodate from 3 to 5 screws. Before operation, the size of the plate to be used can be gauged roughly by placing it against the x-ray film, with due allowance for distortion, and this method has been found

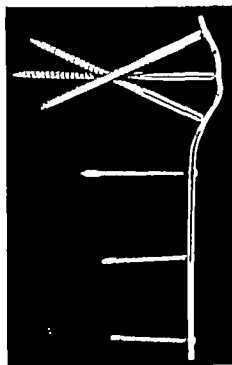


Fig. 1. The Moe plate.

to be quite satisfactory as the distortion encountered is seldom great enough to cause difficulty.

The curved portion of the Moe plate forms the arc of a circle with a radius of approximately 4.5 centimeters. As shown in Figure 1, it is perforated by three screw holes placed 2 centimeters apart. These holes are counter sunk for the head of the Venable wood type hip screws which are used for this portion of the plate. Thus allowance also is made for slight variations in the angle at which the screws are inserted depending upon the conditions encountered at operation. At first glance one would think that the three screws which are inserted across the fracture site and into the cancellous bone of the head and neck of the femur would abut against one another, but in actual practice this problem is seldom encountered. If encountered, it is easily remedied by altering the angle of insertion of the offending screw. In addition, the use of the three large screws provides fixation across the fracture site in three planes and prevents deformity due to rotation besides adequately maintaining reduction.

The straight prolongation of the Moe plate has a varying number of holes as previously mentioned. Stainless steel screws of the Sher-





Fig. 2



Fig. 3

Figs. 2 and 3. Anteroposterior and lateral roentgenograms of comminuted fracture condition which is amenable to Moen plating.



Fig. 4



Fig. 5

Figs. 4 and 5. Postoperative results. Because of severe comminution, third hip screw could not be used. A slight degree of varus deformity is apparent by x-ray examination.

man type are used usually to apply this portion of the plate in the usual manner. One thing that has been noted in this study is that the first or upper hole of the plate portion lies opposite the lesser trochanter and for this reason a longer screw is necessary here than for the rest of the shaft. It is to be emphasized that the screws used should be of the S M O 18-8 group of stainless steel in order to avoid electrolytic osteitis.

Upon admission to the hospital, and after roentgenograms have been taken to determine the type of fracture the patient is placed in traction to minimize pain and shock. If operation is contemplated simple Buck's extension or Russell's traction is usually sufficient. The type of preparation depends upon the preference of the surgeon, some preferring a skin preparation of 2 days, others of 1 day.

The optimum time of operation following injury is controversial. There are some operators (8-9-25) who believe that these patients should be treated as emergency cases. Other surgeons (14-27) believe that operation should not be undertaken for 3 to 4 days during which time it can be determined whether or not the patient will survive the initial shock. In the 30 cases presented in this report the latter method of treatment was used. It is the opinion of the authors that these pa-

tients should be operated upon as soon as possible after the initial shock has been combated by the usual methods. Preoperative care should be directed toward improving the general health of the patient.

In the operating room the patient is prepared and draped in the usual manner with the involved extremity draped free. Again, the type of incision used depends upon the surgeon's preference. The two types used in this series were the straight lateral incision, and later the inverted J shaped incision (Watson Jones) as the latter was felt to provide a greater and easier exposure in the trochanteric region. The incision is made through the deeper layers through the tensor fascia femoris and vastus lateralis muscles to bone. The periosteum is incised and elevated only enough to accommodate the plate. The exposure is made adequate to visualize the fracture line in order to aid in the reduction. If the exposure is carried too far posteriorly below the greater trochanter troublesome bleeding may be encountered from large tributaries of the deep branch of the medial circumflex femoral artery.

When the exposure is adequate the fracture is reduced by traction and manipulation. If the fracture line is exposed the accuracy of reduction can be checked visually. If desired,



Fig. 6



Fig. 7



Fig. 8

Figs. 6, 7 and 8 Postoperative x ray films of Moe plating with either the 2 or 3 hip screw method.

it may be verified by x ray examination. One of the features of the Moe plate is that it may be applied without x ray control which decreases the operating time considerably. In all the cases in this series operation was carried out without x ray control but in the hands of inexperienced operators the use of x ray control is desirable. While the majority of intertrochanteric fractures are reduced by traction and internal rotation combined with abduction it was noted that several in this series required external rotation in order to effect reduction. That this was the case could not be determined from the preoperative roentgenograms.

While the reduction is maintained by an assistant or by mechanical means the plate is placed against the shaft and greater trochanter and as the fit is usually satisfactory further shaping of the Moe plate is not necessary. The outer cortex of the greater trochanter is penetrated with a large size drill point in order to allow for easier introduction of the large Venable hip screws. These screws are furnished in several sizes and their length is determined roughly by comparison with the preoperative x ray films. The direction of the screw is determined by the angle of the femoral neck upon the shaft and can be gauged by a probe or clamp inserted over the anterior surface of the capsule. One of the large screws usually the longest of the three is then inserted in the middle or lower hole of the curved portion. Following this the plate is fixed to

the shaft with a screw through the first hole of the straight portion of the plate. This prevents rotation of the plate while the remaining screws are placed and also fixes the fracture. The remaining screws are then inserted. X ray examination will disclose whether or not the large screws are too long. If any screws project into the acetabulum they should be removed and replaced by shorter ones.

In the markedly comminuted type of intertrochanteric fracture it is not always possible to align all the small fragments but the major fragments can be held without difficulty by the Moe plate as illustrated in Figure 2. It is in these comminuted fractures which cannot be held with other devices that the Moe plate shows its greatest usefulness. In several of the cases in this series the original plan was to use a different fixation device but because of the comminution the Moe plate was the only de-



Fig. 9. Coxa vara deformity

vices that could be used. The cortex in this type of fracture is usually too fragmented to use nails and single large elements and the lines of fracture too diverse for other devices to hold. The Moe plate, however, can be applied and used to maintain the reduction as the curved element depends for its holding power on the grip of the screws in the cancellous bone of the neck and head of the femur proximal to the fracture site. In the presence of marked comminution it is not always possible to use three large Venable hip screws, especially at the uppermost screw hole. In these cases with the use of a special washer provided with the plate, a Sherman type screw can be used to aid in the fixation. In instances where there are complicating subcapitellar fractures in addition to comminution in the trochanteric region, use of the Moe plate was not attempted, as osteotomy offers the only solution as a rule.

After the plate is applied, the solidity of fixation can be tested by moving the hip. The femur will move as one piece if reduction is maintained. The wound is then closed in layers and a dressing applied.

The after care is the same as for any open reduction of hip fractures. It was found that the use of Buck's extension with 5 to 10 pounds traction for 2 to 3 days postoperatively reduced the degree of postoperative pain, probably due to the relief of muscle spasm. The patients are made ambulatory on crutches as soon as possible after operation, usually after learning to get along in a walker first. The time at which patients can be made ambulatory on crutches depends upon the individual's ability and co-operation; provided the patient's general condition does not preclude ambulation. Crutches are used until roentgenograms show that union has taken place, usually in 10 to 16 weeks.

The chief difficulty with either conservative measures or internal fixation including the Moe plate is the frequent coxa vara deformities which may result from too early weight bearing, inadequate reduction or the tendency of patients to bear weight too early in spite of instructions to the contrary (Fig. 9).

This report is concerned with the presentation of 30 unselected cases of intertrochanteric

fractures of the femur which were treated by open reduction and the use of the Moe plate. The patients were treated on the orthopedic and general surgical wards of the Boston City Hospital during the period from July 1, 1946 to August 30, 1947. This figure does not represent the total number for that period but only those for which there is sufficient data and follow up from which conclusions can be formed. The operations were performed by the resident staff and visiting surgeons on those services.

The majority of the 30 patients were charity cases and therefore came from a social status in which poor general health and nutrition was the rule rather than the exception. Consequently the mortality rate in the past has been rather high, about 34 per cent (5). In this series there were 5 postoperative deaths or a mortality rate of 16.67 per cent, a figure which is comparable to that of other reported series of operative cases. These deaths will be taken up in more detail later.

The average age of the patients in this series was 66.7 years, which is slightly lower than that of other reported series. This may be explained in part by the fact that in the city of Boston in the majority of accident cases the patients are brought to the Boston City Hospital regardless of whether they are residents or not, and a large percentage of the total seem to be in the younger age groups.

The mode of accident was usually the same in all cases of this series, namely a slip and a fall, either in the home or on the street. The preoperative methods of traction used were varied depending upon the surgeon's or resident's preference. Fourteen patients were treated with Russell's traction preoperatively, 9 by simple Buck's extension, 3 with balanced suspension traction and skeletal traction through the proximal tibia and 1 first by Buck's and then by Russell's traction. In 3 cases the method used is unknown. The use of traction in this series preoperatively was to alleviate pain and help to make the patient more comfortable.

The interval between the day of admission and the day of operation varied considerably—from 3 days to a maximum of 51 days. The average interval was 12.8 days. The discrep-

ancy between minimum and maximum interval may be accounted for by the fact that operation was performed as soon as possible after admission on the orthopedic service with the 3 day interval being considered necessary at the time to allow the patient to recover from the initial shock and trauma. On the other hand, on the general surgical services operation was usually delayed for one reason or another. In addition several patients on the general surgical services who after conservative treatment showed marked deterioration after 3 to 4 weeks were transferred to the orthopedic service for operation. These were cases in which the illness threatened to be terminal if the patient did not soon become ambulatory. As a result operation was carried out at a late date on several patients as a life saving measure which was not always successful. In 6 of these cases so transferred the reason was given as general debility and decubitus ulcers and the interval between admission and operation in these cases was 31, 24, 51, 23, and 24 days respectively.

It is interesting to note the number of hospital days required for this series of patients was 51.6 days. This is longer than is reported by Morris whose patients had an average hospitalization of 29.5 days and of Harmon whose patients averaged 40 days but it is less than that reported for patients treated by traction (16.24) and less than the average of 62.3 days reported by Johnson for the hanging cast therapy. Part of the length of hospitalization in this series is due to the long interval between admission and operation as explained in a previous paragraph. Another factor which contributed to the prolonged hospitalization was the fact that a number of the patients were destitute and had to be kept in the hospital until the social service department could arrange for placement in a convalescent home or chronic care hospital. This protracted care tended to elevate the general average as 2 cases of this sort were hospitalized for 114 and 112 days respectively. The shortest hospitalization was 21 days which occurred with 3 patients. As reported by Leydig and Brookes the average hospital stay for intertrochanteric fractures was 84.7 days for charity patients

and 56.4 days for private patients. This is an important and pertinent comparison when total hospitalization is discussed, although their series consisted of nonoperative cases. Lucas and Varney reported an average hospitalization of 45 days for operative cases, although Morris' figure for total hospitalization was low. He believed that this figure was increased because many of his patients had inadequate facilities for home care. We believe that in the absence of social service problems it is reasonable to assume that operative treatment will greatly reduce the number of hospital days required for the treatment of this type of fracture.

In any series of operative cases the presence or absence of sepsis should be noted. In our series there was 1 case of a superficial wound infection which responded to local therapy and might well have been due to the handling of the wound beneath the dressing by the patient. Many of the patients received penicillin as a postoperative routine and this may have been a factor in the low incidence of wound infection.

As would be expected in any series which deals with the older age groups, there were several other complications which should be noted. Bronchopneumonia occurred in 5 cases after operation but this disease was nonfatal in all and responded well to treatment. In 3 cases a low-grade fever occurred postoperatively for several days for which no adequate explanation could be found. As most of the patients in this series were checked routinely each day for evidence of thrombophlebitis and phlebotrombosis this mechanism as a cause of the fever can probably be eliminated. Cardiac decompensation occurred in 1 patient after operation. Superficial phlebitis in another and 1 patient had persistent ankle edema of the affected limb following surgery.

Table I summarizes other aspects which were considered in this series. We set up a rather arbitrary classification for these cases before and after operation. Those classified as good include the patients who had no complicating injuries or medical diseases and who were active prior to injury. The 'fair' group includes patients with such conditions

TABLE I.—STATISTICAL BREAKDOWN 30 CASES INTERTROCHANTERIC FRACTURE

Technical surgical difficulties		General condition preoperative		General condition postoperative		Special medication		Deaths	
N	Per cent	No.	Per cent	No.	Per cent	N	Per cent	No.	Per cent
		Good—3	10	Good—10	66.67	Probulin—7	23.33	1	3.33
		Fair—6	20	Fair—5	33.33	No penicillin—3	10.00		
		Poor—9	30	Poor—5	33.33	Transfusions—16	53.33		
		Rarely shock*							

\*One recipient shock on operating table  
 †Either during operation or immediately postoperative

as mild or moderate cardiac decompensation secondary anemias severe arteriosclerosis general debility severe malnutrition mild hemiplegias diabetes of moderate severity moderately poor renal function etc. For those who did not fit in the above categories the classification of 'poor' was made and includes patients with complicating medical conditions of a severe nature. It is the latter group that accounts for the mortality rate of 16.67 per cent which is a figure consistent with the average mortality rate of 17.09 per cent of several reported series of operative cases (9, 11, 13, 16, 17, 21, 25, 26).

Although only a little over 50 per cent of the patients in this series were treated with penicillin for 24 hours before operation we are inclined at the present time to treat all bone repairs with this drug before operation. In the only case in which superficial wound sepsis occurred, the patient received 40,000 units of penicillin every 3 hours for 1 day prior to surgery.

Transfusions of 500 cubic centimeters of whole blood were given to 15 patients either during or immediately following surgery and 1 additional patient required a total of 1,000 cubic centimeters of whole blood to combat shock. The remaining patients were given intravenous fluids during the operative procedure. At the present time, all patients unless robust are given at least 1 transfusion during the operative procedure which enables them to tolerate the surgery much better.

Technical surgical difficulties were few. Of the 30 cases only 3 patients or 10 per cent presented problems of any marked degree. In 1 case the operative procedure was difficult

because of severe comminution at the fracture site and there was some delay in securing reduction and proper alignment of the fragments. The other 2 cases were problematical as 3 or more weeks had elapsed before surgery was undertaken for reasons previously mentioned. In 1 of these a fair amount of osteoid tissue in the midst of a large hematoma was located between the fragments and this had to be evacuated before definitive surgery could be carried out. The third and last case which presented any difficulty was that of a patient who had been treated conservatively for a period of 7 weeks without the appearance of any definite callus by x ray examination. This patient was transferred from a general surgical service to the orthopedic service for surgery because of large decubitus ulcers and progressive mental and physical deterioration. In this instance when the fracture site was exposed attempts to abduct the femoral shaft were futile until the iliopsoas and adductor muscle groups were freed. Therefore, in a review of this series of cases it is apparent that the only real obstacle one may expect to meet is a difficult reduction and prolonged operating time due to comminution of the fragments. This applies only to those cases wherein surgery is performed within a few days after injury. As previously stated no technical surgical difficulties were met in applying the Moe plate once the fracture had been reduced.

In the analysis of the 5 patients who died, all were poor surgical risks. S. C. B. C. H. No. 1237213 was a 90 year old female who had been treated conservatively and had received intensive medical therapy for 16 days prior to operation. As her condition began to deterio-

TABLE II.—RESULTS OF FOLLOW UP EXAMINATIONS AT END OF 6 MONTHS

Patient	Flexion		Internal and external rotation. Hip	Ankle edema	Ambulation	Shortening inches	X-ray examination	Pain
	Hip Degrees	Knee						
	90	45	90% normal	None	Without crutches 1 end of 3 mos.	1/2	Good callus end of postoperative week	None
	Normal	Normal	Normal	None	Without crutches 1 end of 3 mos.	None	Good callus 1 1/2 weeks	None
3	80	90	0°	None	Without crutches 1 end of 3 mos.		Healed 1 1/2 weeks	Pain in region hip joint related to damp weather
4	80	Normal	30°	None	Without crutches at end of 1/2 mos.	1.5	Healed 1 weeks	None
5	80	Normal	External rotation normal. Internal rotation slightly limited	None	Without crutches 1 end of 1 1/2 mos	1/2	Good callus 1 7 weeks	Moderate in damp weather

rate rapidly toward the end of her second hospital week the operation was carried out as a life saving procedure. In spite of transfusions during operation and immediately after operation she lapsed into shock of an irreversible nature and died 2 hours after the operation. In this case, one might argue that it would have been better to let nature take her usual course, but as the situation of the patient was desperate it was felt justifiable to take the risk. The other 4 deaths were among patients who had poor cardiac reserve and their deaths were chiefly cardiac in etiology. M.P. B.C.H. No 1215783, was a 64 year old female who died of a terminal cerebrovascular accident and complicating bronchopneumonia. M.F., B.C.H. No 1228571, was a 73 year old female whose death was due to cardiac decompensation and bronchopneumonia 5 days after operation. Complicating diseases in this patient were arteriosclerotic and hypertensive heart disease and mild diabetes. L.G., B.C.H. No 1225408 was a 75 year old female who died 23 days after operation because of cardiac decompensation and severe diabetes. C.K., B.C.H. No 1240252, was a 75 year old female who died of cardiac decompensation and arteriosclerotic heart disease 55 days after operation with a further complication of bronchopneumonia. It is our belief that the latter 4 deaths could not have been avoided due to the patients extremely poor cardiac reserve, and that in all probability the results without surgery would have been equally disastrous.

Of the total of 30 patients only 5 (16.67%) or 20 per cent of the living were able to return to our follow up for clinical evaluation. As a last resort, questionnaires were sent to all in the hope that we might be able to appraise the end results of this method of treatment of intertrochanteric fractures. Of the total of 20 letters sent, only 11 questionnaires were filled out and returned. Four letters were 'returned to sender—address unknown,' and no reply was received from the remaining 5 patients. In other words, follow up information was obtained from only 64 per cent of those patients believed living.

Table II summarizes the results of the examination in those 5 patients who were seen in the follow up clinic. Of the 11 questionnaires received, 1 indicated that the patient had died of heart disease 10 months after discharge from the hospital. Five patients indicated that they were ambulatory without the aid of crutches and of these 4 were using canes. All 11 patients complained of mild or moderate hip pain aggravated by damp or cold weather. None was bed-ridden, but 2 patients stated they were restricted to armchairs. Six patients complained of mild or moderate stiffness of the knee joint. Seventy per cent reported mild ankle edema which subsided with bed rest and all but 1 patient claimed to have some limitation of hip flexion varying from 50 to 90 per cent. All the reports indicated that the patients were able to cross the injured leg over the uninjured member.

Because of its subjective nature information acquired through questionnaires is not generally as reliable as that acquired through physical examination. However as the patients could not, or would not report to our follow up clinic, we were forced to resort to this inferior method for evaluating the end results of this procedure. The follow up results in these cases include quite a few patients who were seen or heard from more than a year after their operation.

#### CONCLUSIONS

1 The Moe plate is a simple adequate and effective method of immobilization in the operative treatment of intertrochanteric fractures.

2 The application of the Moe plate creates a minimal amount of trauma due to the ease of application and the shortened operative time.

3 X ray control is not necessary but can be used if desired.

4 With this method patients can be made ambulatory on crutches shortly after operation which is an important factor to minimize complications in the older age groups in which this type of fracture most frequently takes place.

5 The mortality rate in this series of 30 cases is 16.67 per cent, which is considerably less than that for so-called conservative methods and the figure is consistent with that reported from other hospitals and clinics for surgically treated intertrochanteric fractures.

6. The Moe plate can be used very satisfactorily in the markedly comminuted intertrochanteric fractures in which it is not possible to maintain reduction with the other types of internal fixation thus far reported in the literature.

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# THE EFFECTS OF VARIOUS TYPES OF SYMPATHECTOMY UPON VASOPRESSOR RESPONSES IN HYPERTENSIVE PATIENTS

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**I**N order to determine the effects of removing various portions of the sympathetic nervous system upon vasomotor reactions it is necessary to measure these reactions in the same individuals both before and after surgery. Thus if responses are shown to occur regularly before sympathectomy and are uniformly absent or altered afterward, one may conclude that the operation has been responsible for the change. For example, vasomotor reactions studied in the limbs by simultaneous measurements of blood flow and blood pressure have been found to be profoundly altered by sympathetic denervation of the parts (4).

In the splanchnic areas of human subjects vasomotor responses are difficult to measure. However, by continuously recording the ballistocardiogram along with the arterial pressure, it has been possible to distinguish the effects of changes in cardiac output from changes in peripheral resistance during vasopressor responses (5, 6). Thus it has been shown that certain vasomotor stimuli regularly cause reactions that can be attributed only to vasomotor activity in areas other than the limbs and brain. The present study was undertaken to determine the effects of surgical removal of various portions of the sympathetic nervous system upon the vasopressor responses of patients to standard stimuli. In this way the roles played by different parts of the sympathetic nervous system in these responses have been demonstrated.

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## METHODS

The subjects were patients, mainly hypertensive, selected for surgical sympathectomy of various types. They were studied before and again approximately 2 weeks after the completion of the operations. In addition certain patients were studied at longer intervals and of these some were studied only after operation.

Measurements were made with the patients lying quietly on the tilting ballistocardiograph (7). Arterial pressure was registered optically by a Hamilton manometer (1) attached to a needle in the brachial or femoral artery. Cardiac output was estimated with the ballistocardiograph (3), and respiration and expiratory pressure were recorded by suitable tampons placed in the same optical system. A number of sympathetic nervous stimuli were applied including tilting into the upright position, production of reactive hyperemia in the limbs, the Valsalva experiment, the cold test and a request to do mental arithmetic. Of these the first 3 were found to be more simple and to cause more regularly a clear-cut vasoconstrictor response. Perhaps this was due to the fact that they were all primarily blood pressure lowering procedures.

With the sudden stopping of a blood pressure lowering procedure the presence of vasoconstriction could be strikingly demonstrated by the appearance of a brief marked hypertensive overshoot that carried the arterial pressure above control levels and could not be explained by increases in cardiac output (5, 6). The stimuli were stopped suddenly as follows. The subject after standing upright for 5 minutes, was quickly tilted back into a horizontal position, similarly, after 15 seconds of reactive hyperemia (due to the release of circulatory arrest which had been in effect during the preceding 5 minute period) in three limbs, the



TABLE L—VASOPRESSOR RESPONSES GRADED BEFORE AND AFTER, OR ONLY AFTER LUMBODORSAL SPANCHINECTOMY\*

Subject	Before operation		Operation	Interval	After operation	
	Arterial pressure	Grade			Arterial pressure	Grade
Tut	170/117	II	R=D8-L8 L=D7-L8	weeks	172/108	Mag
Max	180/95	II	R=D8-L8 L=D8-L8	weeks	180/75	Mag
Fax	162/85	IV	R=D8-L8 L=D8-L8	weeks	152/81	Mag
Fax	200/95	III	R=D8-L8 L=D8-L8	weeks	176/90	Mag
Rox	222/140	III	R=D7-L8 L=D8-L8	weeks	202/100	Mag
Yax	180/100	III	R=D8-L8 L=D8-L8	weeks	172/90	Mag
Bl	176/10	IV	R=D8-L8 L=D8-L8	weeks	152/111	I
Sax	180/100	II	R=D8-L8 L=D8-L8	weeks	142/75	Mag
Pax	190/100	I	R=D8-L8 L=D8-L8	weeks	175/75	Mag
Gax	15/115	III	R=D8-L8 L=D8-L8†	weeks	180/111	Mag
Fax	100/80	II	R=D8-L8 L=D8-L8	weeks	15/85	Mag
Sax	20/30	IV	R=D8-L8 L=D8-L8	weeks	162/95	Mag
Fax	120/80	II	R=D8-L8 L=D7-L8	weeks	120/80	Mag
Wat	5/100	I	R=D8-L8 L=D8-L8	weeks	20/90	Mag
Ph	15/5	II	R=D8-L8 L=D8-L8	weeks	150/7	Mag
Kox	205/7	III	R=D8-L8 L=D8-L8	weeks	152/90	Mag
Nax	120/90	IV	R=D7-L8 L=D8-L8	weeks	120/75	Mag
McCl	20/80	II	R=D8-L8 L=D8-L8	weeks	18/100	Mag
Hax	20/5	II	R=D7-L8 L=D8-L8	weeks	180/80	I
Gel	120/115	II	R=D8-L8 L=D8-L8	months	120/115	Mag
Sax	200/102		R=D8-L8 L=D8-L8	5 months	11/95	I
Dax	200/102		R=D8-L8 L=D8-L8	6 months	205/100	I
Yel	185/102		R=D8-L8 L=D8-L8	years	65/80	II
Bax	200/100		R=D8-L8 L=D8-L8	years	200/90	Mag
Abx	185/120		R=D8-L8 L=D8-L8	5 years	18/115	I
Dax	205/102		R=D8-L8 L=D8-L8	5 years	120/80	I
Rax	15/100		R=D8-L8 L=D8-L8	5 years	20/120	Mag
Cax	45/100		R=D8-L8 L=D8-L8	years	112/75	I
Dax	115/115		R=D8-L8 L=D8-L8	years	120/10	Mag
Lax	115/120		R=D8-L8 L=D8-L8	11 years	120/90	II
Bl	10/100		R=D8-L8 L=D8-L8	6 years	175/80	Mag
OTL	20/8 to 180/100		R=D8-L8 L=D8-L8	9 years	115/85	I

\*In all cases the greater splanchnic nerve was resected bilaterally from the celiac ganglion upwards throughout almost its entire extent. The vagus in common of the sympathetic trunks noted in the table is a mistake.  
 †A right splanchnic had been performed elsewhere weeks previously for "unilateral renal" disease.  
 ‡As reported, taken with splanchnicectomy.

circulation in them was suddenly reoccluded or after 10 seconds of the Valsalva maneuver (forceful expiration against a fixed resistance) the subject was asked to relax quickly and completely. Recording was then continued for at least 1 minute, and ample time for full re-

covery from each stimulus was allowed before applying another.

#### RESULTS

Responses in normally innervated subjects. Any procedure tending to lower the arterial

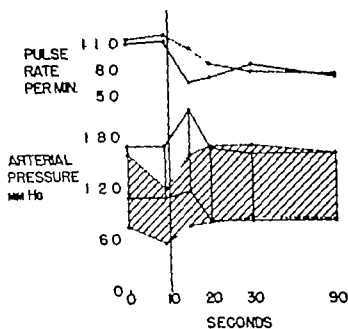


Chart 1. Showing the effects of being quickly tilted (vertical line) from the upright ( $75^\circ$ ) to the horizontal position upon pulse rate, and arterial pressure (Hamilton) of a hypertensive patient before (solid dots and lines) and after (circles and interrupted lines) a lumbar sympathectomy. Before operation the subject had stood 5 minutes at the tilt-back, after operation 5 minutes.

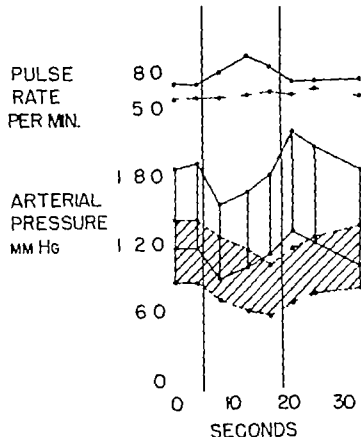


Chart 2. Showing the effects of the release (first vertical line) and reocclusion (second vertical line) of the circulation in three limbs after a preliminary 5 minutes of occlusion in a hypertensive patient before and after a total thoracic sympathectomy. Other notations as in Chart 1.

pressure evoked in normally innervated subjects a marked vasopressor response. When the stimulus was stopped the arterial pressure quickly recovered and then overshoot the control levels, often reaching alarming peaks. These overshoots of arterial pressure furnished an easy and, in a given subject, a fairly reproducible measurement of the degree of vasopressor reaction to the stimuli. For example following a quick return of the subject to the horizontal position after 5 minutes of standing the arterial pressure quickly swung up to levels considerably higher than the previous horizontal controls (Chart 1). Likewise upon reocclusion of the circulation in the limbs after 15 seconds of reactive hyperemia and an associated fall in arterial pressure there was an overshoot to levels higher than existed before the release of the cuffs (Chart 2). Finally, following the Valsalva maneuver there was a marked overshoot of arterial pressure above the control level (Chart 3), sometimes to more than 300 millimeters of mercury (Chart 6).

The characteristic overshoots of arterial pressure that occurred after stopping such stimuli in normally innervated subjects usu-

ally appeared within 5 seconds and reached a peak within 15 seconds. They then moderated and frequently disappeared within 30 seconds after the end of the stimulus although they occasionally persisted for a minute or more. No response was accepted as neurogenic in origin that was not present within 15 seconds of stopping the stimulus.

**Grading vasopressor reactivity.** Because of the ease and objectivity of using these overshoots of arterial pressure to measure vasopressor reactions to blood pressure lowering stimuli they were graded as negative, or grade I, II, III, or IV on the basis of their relative height. Thus, after the Valsalva stimulus rises in mean arterial pressure less than 5 per cent above the previous control levels were accepted as negative. Overshoots of 5 to 14 per cent, 15 to 24 per cent, 25 to 34 per cent, and 35 per cent or over were designated as grades I, II, III, and IV respectively. Of all

<sup>1</sup>Arithmetic mean calculated simply as one-half the sum of the systolic and diastolic pressures.

TABLE II.—VASOPRESSOR RESPONSES GRADED BEFORE AND AFTER, OR ONLY AFTER OTHER TYPES OF SYMPATHECTOMY\*

Subject	Before operation		Operation	After operation		
	Arterial pressure	Grade		Interval	Arterial pressure	Grade
Dlc	86/56	IV	Unilateral (right) upper thoracic† D7-D8	week	145/86	II
Bud	96/70	II	Unilateral (left) subcostal thoracic C inf. -D9	weeks	144/70	I
Rm	115/100	I	Unilateral (right) total thoracic D7-D	weeks	126/75	I
Sac	100/70	II	Unilateral (right) total thoracic D7-D9	weeks	170/100	II
Dc II	104/100	IV	Unilateral (right) lumbodorsal D4-L1	weeks	124/75	III
Rub	96/75	IV	Upper thoracic† D7-D8	week	135/65	II
Dc	106/80	IV	Upper thoracic† D7-D8	week	124/70	I
Bud	96/70	II	Subcostal thoracic (left) C inf. -D9 & greater splanchnic nerve s. Spinal neurectomy (left) T7-T8; s. Upper thoracic (right) D7-D9†	5 weeks	157/75	I
WU	85/70	III	Total Thoracic L=D7-D L=D-D	weeks	126/86	III
Rm	115/70	I	Total Thoracic R=D7-D L=D-D	weeks	96/110	Sac
Sac	90/120	II	Total Thoracic R=D7-D L=D7-D2	weeks	124/80	III
Om	90/75	I	Total Thoracic R=D7-D L=D7-D2	weeks	125/75	III
PM	115/115		Total thoracic (left) C inf. D7 Lumbodorsal (right) D5-L4	1 year	175/70	II
Dca	124/90	IV	Superdiaphragmatic R=D7-D1 L=D8-D	weeks	135/75	IV
Sm	96/120†		Superdiaphragmatic	1½ years	132/115	I
Cu	90/90 180/100†		Superdiaphragmatic R=D7-D L=D9-D	years	171/75	II
Uu	126/140†		Superdiaphragmatic	5 years	157/70	III
Uup	90/90†		Superdiaphragmatic	6 years	190/75	II
Am	90/90†		Infra-diaphragmatic†	4½ years	140/130	III
Rub	124/120†		Infra-diaphragmatic† R=L1-L2 L=L4-L5	8½ years	126/110	II

\*The first fascicles in Table I applies except as noted. The exact extent of previous operations, wherever has been indicated where known.

†Greater splanchnic nerve(s) left intact.

‡Lateral section of dorsal and ventral spinal nerve roots proximal to dorsal root ganglia and excision of segments C6 or more lateral, including roots, ganglia, and mixed nerves. Intervals between the operations listed were 2 weeks between first and second, and 16 weeks between second and third.

§The three splanchnic nerves presumably were divided bilaterally below the diaphragm. No information was available as to the ganglia present. Sympathectomy also was performed with the sympathectomy in two stages.

†As reported, taken with sympathectomy.

the stimuli tried the Valsalva maneuver was the most useful because it was easy and quick to do and could be repeated as often as desired. Therefore it came to be the standard test in grading vasopressor reactivity. Nevertheless the other two stimuli were also applied when ever possible and responses to them were used if necessary in grading reactivity.

*Effects of various types of sympathectomy*  
After surgical removal of various portions of the sympathetic nervous system in these subjects pressor responses to the same stimuli were frequently changed. This was evident most strikingly when there was a complete abolition or a great reduction in the overshoots that previously had occurred after stopping

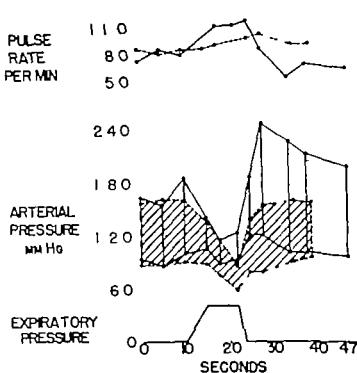


Chart 3. Showing the effects of the Valsalva maneuver (10 seconds of forced expiration) in a hypertensive patient before and after a lumbodorsal sympathectomy. Other notations as in Chart 1.

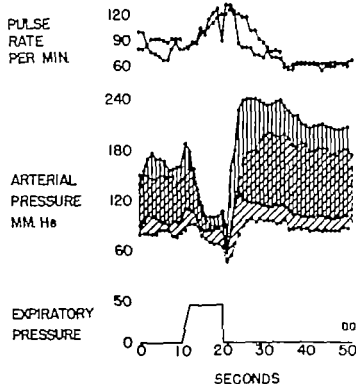


Chart 4. Showing the effects of the Valsalva maneuver in a hypertensive patient before and after a supradiaphragmatic splanchnicectomy. Other notations as in Chart 3.

such stimuli. Instead of the quick swing above the control level there was now a slow recovery, often requiring 15 to 45 seconds to return to the control level (Charts 1, 2, 3, 5, 6). Thus patients previously rated as strong reactors to the stimuli became negative or low grade reactors.

Table I summarizes the results in a group of patients studied before and after or only after lumbodorsal splanchnicectomy (2). Prior to operation the responses of all except 2 of 20 patients were grade II or higher, whereas shortly (about 2 weeks) after operation with two exceptions they were all negative. Of 12 patients studied late (5 months to 9 years) after lumbodorsal sympathectomy 2 had grade II, 6 had grade I, and 4 had negative responses. Four patients who before total thoracic sympathectomy were grade III, I, II, and I reactors respectively became negative after operation (Table II) (Chart 2).

On the other hand patients with less extensive operations remained reactive to the blood pressure-lowering stimuli (Table II). After unilateral sympathectomy, whether lumbodorsal, total thoracic, or cardiac in type, definite though sometimes reduced vasopres-

or responses were observed. Bilateral cardiac (upper thoracic) sympathectomy considerably modified but did not abolish the vasopressor overshoot. Thus 2 young patients complaining of nervousness, tachycardia, and palpitation were both grade IV reactors before cardiac sympathectomy, whereas after ward they were relieved of their complaints and were only grade I and II reactors, respectively. Another patient (grade II) who for the relief of angina pectoris had a subtotal thoracic sympathectomy and greater splanchnic neurectomy on the left side and an upper thoracic sympathectomy on the right side was a grade I reactor 5 weeks after the last operation. (The second of his 3 operations listed in Table II was done in an effort to relieve persistent thoracic pain.) A fourth patient, who had had a left total thoracic sympathectomy and a right lumbodorsal splanchnicectomy because of angina pectoris associated with hypertension, presented the interesting finding of grade II reactivity  $1\frac{1}{4}$  years postoperatively (Table II).

In one young male ("Dun") who wished to avoid any possibility of sterility a supradiaphragmatic splanchnicectomy was performed,

TABLE III.—VASOPRESSOR RESPONSES GRADED BEFORE AND AFTER, OR ONLY AFTER EXTENSION OF SYMPATHECTOMY\*

Subject	Previous operation	Interval	Arterial pressure	Grade	Extending operation	Interval	Arterial pressure	Grade
Ebp	Supradiaphragmatic	2½ years	96/ 5	II	Transthoracic R=D <sub>7</sub> -D <sub>10</sub> L=D <sub>7</sub> -D <sub>10</sub>	weeks	120/130	Neg
Crs	Supradiaphragmatic R=D <sub>7</sub> -D <sub>7</sub> L=D <sub>7</sub> -D <sub>7</sub>	years	175/1 5	II	Transthoracic L=D <sub>7</sub> -D <sub>7</sub> R=D <sub>7</sub> -D <sub>7</sub>	weeks	115/90	Neg
Utt	Supradiaphragmatic†	4½ years	15/ 30	III	Unilateral (right) Lumbodorsal D <sub>7</sub> -L <sub>4</sub>	week	90/130	I
Ul	Supradiaphragmatic†	4½ years	15/130	III	Lumbodorsal R=D <sub>7</sub> -L <sub>4</sub> L=D <sub>7</sub> -L <sub>4</sub>	weeks	90/100	Neg
And	Infradiaphragmatic	4½ years	140/130	III	Lumbodorsal R=D <sub>7</sub> -L <sub>4</sub> L=D <sub>7</sub> -L <sub>4</sub>	weeks	90/130	Neg
Rch	Infradiaphragmatic R=L <sub>7</sub> -L <sub>7</sub> L=L <sub>7</sub> -L <sub>7</sub>	8½ years	40/110	II	Supradiaphragmatic R=D <sub>7</sub> -D <sub>7</sub> L=D <sub>7</sub> -D <sub>7</sub>	weeks	115/90	Neg
Tho	Lumbodorsal R=D <sub>7</sub> -L <sub>4</sub> L=D <sub>7</sub> -L <sub>4</sub>	years	140/ 60		Transthoracic L=D <sub>7</sub> -D <sub>7</sub> R=D <sub>7</sub> -D <sub>7</sub>	3 weeks	90/90	Neg
Kem	Lumbodorsal R=D <sub>7</sub> -L <sub>4</sub> L=D <sub>7</sub> -L <sub>4</sub>	years	175/ 10		Transthoracic L=D <sub>7</sub> -D <sub>7</sub> R=D <sub>7</sub> -D <sub>7</sub>	7 months	140/95	Neg
Als	Lumbodorsal R=D <sub>7</sub> -L <sub>4</sub> L=D <sub>7</sub> -L <sub>4</sub>	½ years	15/115	I	Transthoracic‡ R=D <sub>7</sub> -D <sub>7</sub> L=C <sub>12</sub> -D <sub>1</sub>	weeks	905/105	Neg
Rat	Lumbodorsal R=D <sub>7</sub> -L <sub>4</sub> L=D <sub>7</sub> -L <sub>4</sub>	3 years	190/ 30	Neg	Transthoracic R=D <sub>7</sub> -D <sub>7</sub> L=D <sub>7</sub> -D <sub>7</sub>	weeks	120/120	Neg
Ovs	Lumbodorsal R=D <sub>7</sub> -L <sub>4</sub> L=D <sub>7</sub> -L <sub>4</sub>	3 years	95/115		Transthoracic L=D <sub>7</sub> -D <sub>7</sub> R=C <sub>12</sub> -D <sub>7</sub>	year	105/ 30	Neg

\*Remaining portions of the greater splanchnic nerves were removed entirely whenever possible. The exact extent of previous operations elsewhere has been indicated when known. Numbers designating sympathetic ganglia and segments of trunks enclosed are inclusive. The first five patients are listed also in Table II, and patients "Als" and "Rat" also in Table I.

†L<sub>7</sub> refers to the splanchnic nerve as removed above the diaphragm on both sides as well as corresponding portions of the sympathetic trunk. ‡Total resection of sympathetic trunk with only thoracic chain ganglia below L<sub>4</sub> or L<sub>5</sub> remaining. Intervertebral spinal innervation of the segment of the third intercostal nerve was also performed bilaterally. The final surgical result on all patients total sympathectomy.

As reported, taken with sphygmomanometer.

leaving the lumbar ganglia intact. He was a grade IV reactor before surgery with a 50 per cent overshoot of the mean arterial pressure after the Valsalva test and following operation he was still grade IV with a 40 per cent overshoot (Table II) (Chart 4). Of 4 other patients studied 1½, 4, 4½ and 6 years, respectively after similar operations one was a grade III, two were grade II and one was a grade I reactor. The grade III reactor was reduced to grade I after unilateral and to negative after bilateral lumbodorsal extension downward (Table III). The two grade II reactors both became negative after transthoracic extension upward (Table III) (Chart 5).

Two patients who 8½ and 4½ years previously had had infradiaphragmatic operations were grades II and III respectively but after a supradiaphragmatic extension in the first and a lumbodorsal extension in the second both were negative (Tables II and III) (Chart 6). Three patients who already had had "subtotal sympathectomy" (lumbodorsal previous-

ly followed by transthoracic extension) before they were studied were all negative reactors (Table III). Two others were grade I and negative respectively about 3 years after a previous lumbodorsal sympathectomy and both were negative 2 weeks after transthoracic extension of the sympathectomy upward.

#### DISCUSSION

The methods described above seem to furnish a means of assessing the relative amount of sympathetic nervous vasopressor reactivity especially in any one individual tested under different conditions as before and after sympathectomy. The Valsalva test in particular appears to be valuable clinically since the degree of overshoot following this one simple maneuver seems to be well correlated with the amount of splanchnic sympathetic innervation remaining intact, provided the cardiac accelerator nerves have not been interrupted.

It appears that such vasopressor responses to blood-pressure lowering stimuli depend up-

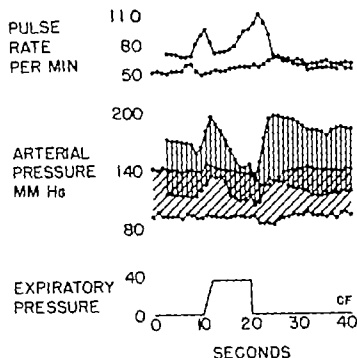


Chart 5. Showing the effects of the Valsalva maneuver before and after an extension of a supradiaphragmatic splanchnicectomy to a total thoracic sympathectomy. Other notations as in Chart 3.

on the *quantity* as well as the *location* of the functioning sympathetic nervous tissue. Thus a total thoracic sympathectomy in which the lumbar ganglia are left intact is more effective in abolishing the responses than is a supra diaphragmatic splanchnicectomy or an upper thoracic sympathectomy leaving the same ganglia intact. On the other hand, an infra diaphragmatic operation removing the first and second lumbar ganglia but extending upward only to include the 12th dorsal ganglia is less effective in reducing the overshoots than is a lumbodorsal sympathectomy from the 8th dorsal through the first lumbar ganglia. However a total thoracic sympathectomy or even a "subtotal sympathectomy" (lumbodorsal plus upper thoracic denervation) is no more effective than a complete lumbodorsal operation. In fact, it is possible that total thoracic sympathectomy may appear to be more effective in abolishing purely vasoconstrictor activity than it actually is, since by preventing the cardiac acceleratory component of the vasopressor response it retards and lessens the overshoot masking any vasoconstriction that may be present. A simple cardiac denervation (i.e. a high thoracic sympathectomy) likewise minimizes the acceleratory

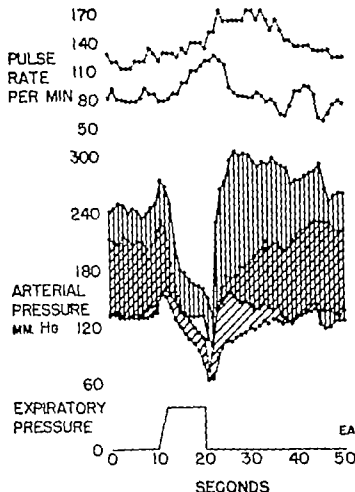


Chart 6. Showing the effects of the Valsalva maneuver before and after an extension of an infradiaphragmatic splanchnicectomy to a lumbodorsal splanchnicectomy. Other notations as in Chart 3.

response but also decreases both the diastolic and systolic overshoot suggesting that certain fibers concerned in the vasoconstrictor reaction may be interrupted by the operation.

From the study of cases long after operation it appears that the type and extent of the original surgical procedure are more important factors than is the elapsed time in affecting the vasopressor response found later. This indicates that after extensive operations regeneration is usually slight, a most important fact to know whenever a poor result or a recurrence of symptoms is found after operation.

Finally, the results show that sympathetic vasopressor responses to blood-pressure lowering procedures may be superimposed upon any grade of basal arterial pressure, the height of which may bear no direct relationship to the degree of this type of activity and may or may not be changed by procedures which profound

ly alter the reflex responses. If superimposed upon a high basal level of arterial pressure such reactions may result in dangerously high peaks during which vascular rupture or other types of damage may occur. In such cases it would seem wise to abolish the reflex vasopressor responses even when the basal levels of arterial pressure might not be lowered by the operation. This conclusion apparently has been justified by the more benign course of many hypertensive patients after a sympathectomy which has failed to produce a significant change in the basal arterial pressure.

#### SUMMARY AND CONCLUSIONS

1. Overshoots of arterial pressure appearing quickly after the cessation of blood-pressure-lowering procedures furnish a means of grading the amount of sympathetic nervous vasopressor reactivity of human subjects.
2. The grade of vasopressor reactivity of a subject is markedly decreased or abolished

after extensive bilateral sympathectomy. It is less affected by less extensive sympathetic denervations.

3. The grade of vasopressor reactivity is not necessarily related to the resting level of arterial pressure of a subject.

4. The abolition of overshoots of arterial pressure in hypertensive patients appears highly desirable.

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# FECAL CONTINENCE FOLLOWING RESECTIONS OF VARIOUS PORTIONS OF THE RECTUM WITH PRESERVATION OF THE ANAL SPHINCTERS

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**I**N a previous communication studies on the physiology of fecal continence in normal individuals were presented (2). The purpose of this paper is to present similar studies of 4 patients in whom the anal sphincters have been retained following resections of various portions of the sigmoid colon and rectum. Interpretation of these studies is aided by kymographic tracings of the anal reflexes obtained on stimulation of different levels of the sigmoid and rectum in normal individuals. These studies indicate that the rectum itself is an integral part of the sphincteric apparatus and that the retained sphincters are incapable of maintaining sphincteric continence if too much of the rectum is removed.

## SPHINCTERIC CONTINENCE IN NORMAL INDIVIDUALS

It is of the greatest importance to understand that fecal continence may be of two types: colonic and sphincteric. Colonic continence refers to the plastic adaptation of the smooth muscle of the colon to the enlarging fecal mass; it is retained following resections of the rectum whether the sphincters are preserved or not. Thus even in patients with abdominal colostomy in whom there is no sphincteric apparatus, attention to diet and colonic irrigations at regular intervals eventuates in a type of continence which is surprisingly satisfactory. Failure to evaluate the role played by colonic continence when the anal sphincters have been preserved following resections of the rectum may lead to erroneous conclusions as to the efficiency of the retained sphincters.

Sphincteric continence refers to the conscious and especially to the reflex retention of

bowel contents by contraction of the external sphincter muscle. The internal sphincter, which relaxes when the rectum is stimulated, appears to play no part in sphincteric continence. Since sphincteric contraction is not associated with any damping effect on colonic peristalsis (1), the closing force of the sphincter must exceed the propulsive force of the colon in order to be effective. The normal external anal sphincter has been shown to lack endurance. This lack of endurance makes necessary a mechanism whereby the sphincter may be warned as to when and to what degree its services are required. Previously reported studies of normal individuals indicate that such a mechanism exists in the form of a reflex arc. The afferent fibers of this arc arise in the wall of the rectum and communicate at cerebral levels with efferent fibers which terminate in the external anal sphincter (2).

Under normal circumstances colonic and sphincteric continence are of equal importance. Colonic continence appears to be responsible for the retention of feces over long periods of time through the plastic adaptation of the smooth muscle of the colon. When this plastic adaptation reaches an end and peristalsis begins, the fecal masses are pushed into the rectum in the wall of which afferent impulses are initiated. These afferent impulses traveling over nervous pathways, (a) give rise to a sensation of imminent defecation located in the perineum and (b) initiate a reflex by which the external sphincter is able to contract sufficiently to resist the propulsive force of colonic peristalsis. Sphincteric resistance to colonic peristalsis is followed by further plastic adaptation of the colon and rectum and appropriate relaxation of the sphincter. Sphincteric continence is therefore an emergency mechanism which is called into play for only relatively short periods of time.

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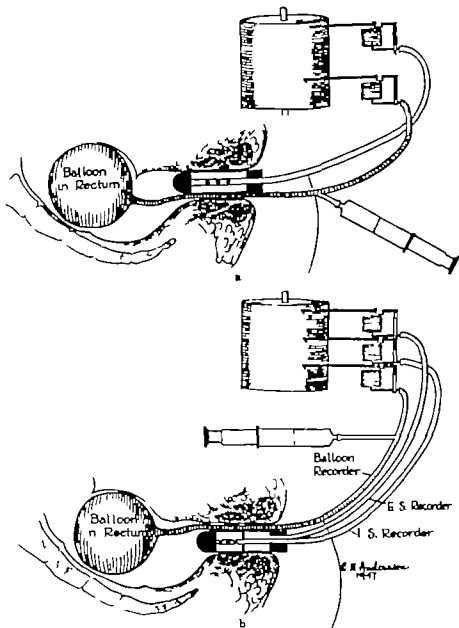


Fig. a, Single obturator method of recording changes in sphincter tone that accompany stimulation of the rectum. b, Double obturator method which permits simultaneous and independent recording of the changes of tone of the internal and external sphincters.

#### METHODS AND MATERIAL

The anal reflexes were studied by means of the apparatus illustrated in Figures 1a and b. The rectum or colon was stimulated with a rubber balloon which was filled by increments and emptied by decrements with a syringe. Pressure changes in the balloon were recorded

kymographically. Changes in anal sphincter tone resulting from this stimulation were also recorded kymographically by means of a single (Fig. 1a) or double (Fig. 1b) obturator. The combined activities of the internal and external sphincters were recorded by placing the single obturator across the entire anal

canal. When the single obturator was pushed into the anal canal so that only its proximal half was recording, while its distal half protruded into the cavity of the rectum, changes of tone of the internal sphincter were recorded. When the single obturator was pulled partially out of the anal canal so that only its distal half was compressed it was possible to record the activity of the external sphincter. The double obturator was divided by a thin metal septum into proximal and distal compartments each of which was connected for independent kymographic recording. When the septum was placed at about the middle of the anal canal the activities of the internal and external anal sphincters were recorded simultaneously and independently.

By these methods studies were made of the anal reflexes of 12 normal individuals in whom the stimulating balloon was placed at various levels in the sigmoid and rectum. Studies were also made on 4 patients in whom the following surgical procedures had been previously carried out: (1) resection of the distal sigmoid colon and all of the rectum with anastomosis at the mucocutaneous line; (2) anterior resection of the sigmoid with anastomosis at the level of the peritoneal reflection; (3) resection of the sigmoid and upper half of the rectum with anastomosis 7 centimeters above the anus; (4) resection of the sigmoid and rectum with anastomosis 1 centimeter to 2 centimeters above the anus.

The number of surgical cases is small because the indications for sphincter preservation in the presence of malignancy have been rigidly limited to the following situations: (1) very early tumors involving one half or less of the circumference of the bowel and with the lower border of the tumor at least 6 centimeters and preferably 8 centimeters or more above the proposed site of anastomosis; (2) palliative resections done in the presence of liver metastases when the tumor lies at least 5 centimeters above the site of anastomosis.

### RESULTS

*A. The anal reflexes resulting from stimulation of different levels of the rectum and sigmoid in normal adults.* In 12 normal adults the changes in tone of the internal and external

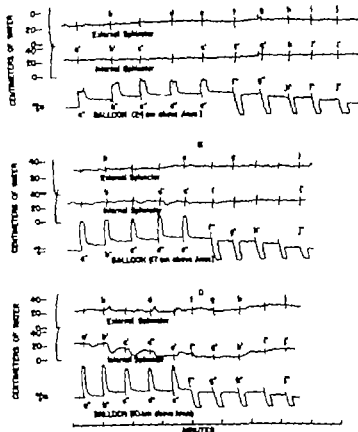


Fig. 2. Kymographic tracings of the changes of external and internal sphincter tone in a normal adult with the stimulating balloon placed at various levels above the anus. In A, the balloon was 24 centimeters above the anus, in B, 17 centimeters above the anus and in C, 10 centimeters above the anus. Small letters of each test indicate simultaneous ordinates. Pressure scales in centimeters of water.

anal sphincters were recorded during stimulation of the sigmoid colon and rectum at various levels by means of the balloon. All such experiments gave essentially similar findings and a typical example is illustrated in Figure 2. A, B and C of Figure 2 are the results of three separate tests made in the same individual with the balloon at different levels. These and subsequent illustrations are similarly arranged so that the upper line represents the activity of the external sphincter, the middle line the internal sphincter, and the lower line the filling (upward curves) and emptying (downward curves) of the balloon by increments and decrements. In all tests illustrated in Figure 2 the increments and decrements were each 50 cubic centimeters. Simultaneous ordinates on the three graph lines of each test are indicated by small letters.

During test A the stimulating balloon was placed in the sigmoid colon 24 centimeters

above the anus. Filling the balloon with 5 increments caused no change in the tonus of either the internal or external anal sphincter. The same is true of the 5 decrements by which the balloon was emptied. In test B the balloon was placed in the upper rectum 17 centimeters above the anus. With each increment of filling of the balloon the internal sphincter tone fell for a short time after which it returned to the preinjection level. There was no change in external sphincter tone during these injections. No significant changes of either internal or external sphincter tone were recorded with the decrements of emptying. In test C the balloon was placed 10 centimeters above the anus. Each increment of filling was accompanied by a partially sustained fall of internal sphincter tone of significant degree. During the decrements of emptying of the balloon there was a considerable recovery of internal sphincter tone. At the same time that the internal sphincter tone was falling the external sphincter tone not only did not fall but, at points *a b d* and *e* showed significant elevations of a short period of time.

Figure 2 demonstrates that both the internal and external sphincter responses become more active when the stimulating balloon is placed closer to the anus. When the stimulus is applied to the sigmoid colon no reflex activity of either sphincter is recorded. When the stimulus is applied to the upper rectum the sphincter responses are present but feeble. They become progressively greater as the stimulus is applied closer to the anus. These findings indicate that the receptor units of the anal reflexes are absent in the sigmoid colon that they are relatively sparse in the upper rectum but that they become progressively more numerous per unit area as the anus is approached. This receptor mechanism present only in the rectum is therefore the origin of afferent stimuli by means of which warning is given to the external sphincter as to when and to what degree contraction is required to maintain sphincteric continence. The consistent fall of internal sphincter tone when the rectum is stimulated illustrates again that this part of the sphincteric mechanism prepares the way for evacuation of feces and that it plays no part in sphincteric continence.

The sensations resulting from distending a balloon in various parts of the colon and rectum have been described by Hertz, and were amply confirmed in this group of normal individuals. When the balloon was placed in the sigmoid its distention caused discomfort in the lower abdomen usually in the midline but often in the left lower quadrant. Distention of the balloon when it was in the upper rectum caused a sensation in the sacral or perineal region that was interpreted as an urge to defecate. The lower in the rectum the balloon was placed the greater was the sacral or perineal sensation that resulted from an equal degree of distention. An evaluation of the sensation experienced by the patient when defecation was imminent was thus of some value in establishing the presence of functioning afferent nerve fibers arising in that portion of the rectum that had been retained.

*B Loss of sphincteric continence following resection of all of the rectum.* A 53 year old woman (Framingham Union Hospital No. 72755) had an early grade 2 adenocarcinoma involving one third of the circumference of the rectum. The lower border of the tumor was 8 centimeters above the anus. Eighteen months before this study the distal half of the sigmoid and all of the rectum were resected and an anastomosis of the sigmoid colon to the anal canal at the level of the mucocutaneous line was accomplished a modification of the "pull through" technique being used. A transverse colostomy was also done. After healing was complete and the line of anastomosis had been dilated to normal size the transverse colostomy was closed.

Since recovery from the operation the patient remains able voluntarily to contract the anal sphincter with good force and healing has been so perfect that on examination, there is little to suggest that the rectum has been removed. In spite of this apparently perfect anatomical result she remains unable to retain gas and feces.

This intelligent and co-operative patient has made pertinent observations on the mechanism of the incontinence. She states that the perineal sensation which before operation indicated a desire to defecate is no longer present. When gas or feces passes through the anal canal

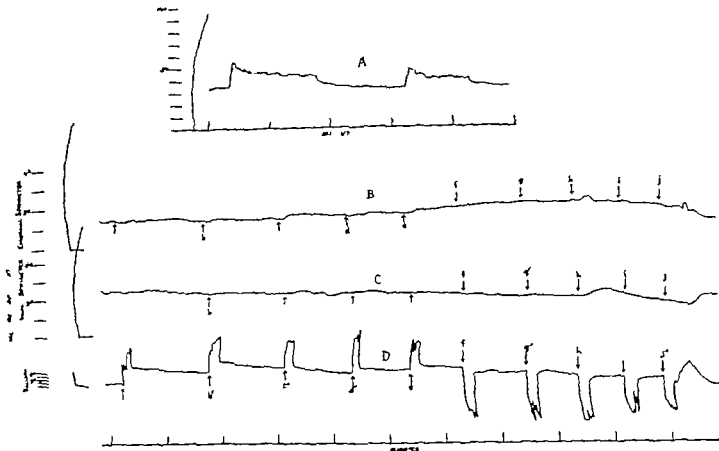


Fig. 3. Tracings taken from patient in whom the entire rectum was resected with anastomosis of sigmoid to anus at the mucocutaneous line. A, Single obturator across entire anal canal records two voluntary sphincter contractions.

B External sphincter tone and C, internal sphincter tone recorded simultaneously with the double obturator D, filling a to e and emptying, f' to j' of balloon placed 10 centimeters above the anus.

however, a normal sensation of evacuation is present. When the anal sensation is noted the sphincter is voluntarily contracted but not until after some gas or feces has escaped. In other words she has no knowledge of when or to what degree to contract the external sphincter until bowel content has passed beyond the point where it can be controlled by sphincteric contraction.

This analysis by the patient was confirmed by carefully observing sphincteric activity during an enema. The colon was sufficiently filled to set up peristaltic waves which were recorded kymographically, and it was shown that each elevation of pressure in the 'rectum' preceded by an appreciable period the onset of sphincteric contraction. It was repeatedly noted that sphincteric contraction did not take place until after enema fluid had escaped through the anal canal.

The effect of resection of the rectum on the anal reflexes in this patient is illustrated in Figure 3. The graph line marked 'A' was

made with the single obturator across the entire anal canal and records two voluntary sphincter contractions both of which fall well within the range of normal in both strength and duration (2). These indicate a good anatomical result. Lines 'B' and 'C' indicate respectively the activities of the external and internal sphincters as recorded with the double obturator during stimulation of the bowel by means of a balloon placed 10 centimeters above the anus. Line 'D' shows 25 cubic centimeter increments of filling (upright curves a' to e') and decrements of emptying (downward curves f' to j') of the balloon. As would be expected from the results of tests on normal individuals no reflex activity of the sphincters resulted from stimulation of that portion of the sigmoid colon which had been placed in the pelvis to replace the resected rectum and the similarity to test A in Figure 2 is evident.

During recent months this patient has been on a colostomy regimen, consisting of a constipating diet and colonic irrigations every sec

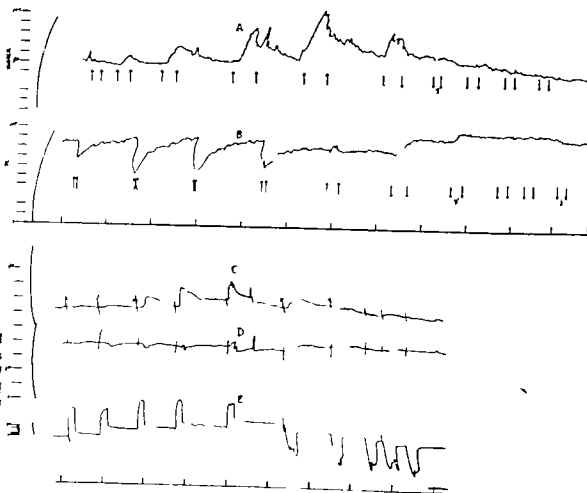


Fig. 4. Resection of sigmoid colon with anastomosis at level of peritoneal reflection. A, External sphincter and B internal sphincter recorded with the single obturator. Arrows pointing up indicate increments of filling of the balloon placed 1 centimeter above the anus. Arrows pointing

down indicate decrements of emptying of the balloon. C, External sphincter and D, internal sphincter tone recorded simultaneously with the double obturator. E, Filling and emptying of the balloon placed 1 centimeter above the anus.

and day. By this means regular bowel habits have developed to such a degree that she is rarely embarrassed. This is the same type of continence that is developed by patients with abdominal colostomy. It is colonic continence and has nothing to do with the retained anal sphincters. The retained sphincters are of no practical value and, from the standpoint of fecal continence, the patient has no more than a perineal colostomy. It is of some interest that she much prefers the present perineal opening to the abdominal colostomy which for several months she managed with equal skill. The chief reason for this preference is the greater ease and cleanliness with which colonic irriga-

tions can be evacuated through the perineal opening. The cosmetic disadvantages of the abdominal colostomy are an important secondary reason.

C Preservation of sphincteric continence following anterior resection of the sigmoid with anastomosis at the level of the peritoneal reflection. Because the anal reflexes are elicited in normal adults only on stimulation of the rectum and not on stimulation of the sigmoid colon it might be anticipated that sphincteric continence would not be altered by anterior resection of the sigmoid with anastomosis at the level of the peritoneal reflection. That such is the case is illustrated in Figure 4. These

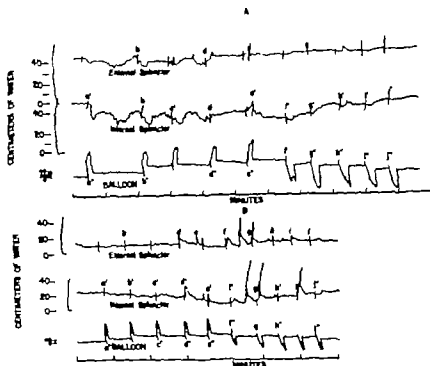


Fig 5 Resection of sigmoid and upper rectum with anastomosis 7 centimeters above the anus. A Before operation. External and internal sphincter tone recorded simultaneously with double obturator Balloon 10 centimeters above anus. B After operation, double obturator method. Balloon 5 centimeters above anus.

graphs were obtained from a 61 year old woman (Framingham Union Hospital No 75445) following resection of a grade 3 adenocarcinoma of the middle of a long loop of sigmoid colon. The sigmoid and its mesentery were resected and an anastomosis was completed between the descending colon and the 'rectosigmoid junction'. Following recovery the patient noted no change in her ability to retain gas or feces by sphincteric contraction and imminent defecation was associated with a normal perineal sensation.

In Figure 4 lines "A" and "B" representing respectively the activities of the external and internal sphincters were obtained with the single obturator. The balloon was placed 10 centimeters above the anus. Arrows pointing upward indicate the beginning and end of injections of 50 cubic centimeter increments into the balloon (a to c and a' to c') while arrows pointing down (f to j and f' to j') indicate the withdrawal of 50 cubic centimeters decrements. The normal contraction response of the external sphincter and the normal relaxation response of the internal sphincter are well shown. Lines "C" (external sphincter) and "D" (internal sphincter) were obtained simul-

taneously with the double obturator. Line 'E' shows the filling (upward curves) and emptying (downward curves) of the balloon placed 10 centimeters above the anus. Normal reflex responses of both sphincters are again evident. These findings indicate that the rectoanal reflexes have not been altered by resection of the sigmoid colon.

*D Preservation of sphincteric continence following resection of the sigmoid and upper rectum with anastomosis 7 centimeters above the anus.* Since it has been shown that resection of all of the rectum causes loss of sphincteric continence while resection of the sigmoid with preservation of the rectum does not alter sphincteric continence the question arises as to how much rectum must be retained, along with the sphincters to conserve sphincteric continence. That sphincteric continence is retained when the distal half of the rectum is preserved is illustrated by the following case.

A 64 year old man (Framingham Union Hospital No 77927) was found to have an annular grade 3 adenocarcinoma of the sigmoid 20 centimeters above the anus. There was in addition a malignant rectal polyp 0.5 centimeter in diameter located 10 centimeters above the

anus. At operation the tumor of the sigmoid was found to have invaded the serosa and 6 or 8 metastatic masses each about 2 centimeters in diameter were palpated in the liver. A palliative resection of the sigmoid and of the proximal half of the rectum was done. A rectosigmoidal anastomosis 7 centimeters above the anus was established by a modification of the "pull through" technique.

Since recovery from the operation the patient has noted absolutely no change in his ability to retain bowel contents by sphincteric contraction. Imminent defecation is associated with a normal perineal sensation which is in no way altered from the preoperative state. Bowel habits have not been changed and it has not been necessary to resort to cathartics enemas or change of dietary habits.

Preoperative and postoperative studies of the rectoanal reflexes are illustrated in Figure 5. Both studies were done with the double obturator. In graphs A obtained before operation the balloon was placed 10 centimeters above the anus and was filled and emptied by increments and decrements of 50 cubic centimeters each. Due to a considerable degree of overlapping of the internal sphincter by the external, the two graphs of sphincter activity show a superficial similarity. It is possible, however, to distinguish the sustained fall of internal sphincter tone resulting from filling of the balloon and the recovery of tone as the balloon is emptied. There is no sustained fall of the tone of the external sphincter and purposeful contractions of the external sphincter may be readily distinguished.

In graphs B obtained after operation it was necessary to use a smaller doughnut shaped balloon placed 5 centimeters above the anus. Because of the smaller area of rectum available for stimulation the balloon was filled and emptied by increments and decrements of 25 cubic centimeters each. Again the overlapping of one sphincter by the other makes the two graph lines superficially similar yet it is possible to distinguish the sustained fall of internal sphincter tone and the sharp momentary contractions of the external sphincter as the balloon is filled.

Both the clinical and experimental findings in this case indicate that sphincteric continence

is not compromised following rectosigmoidal resection when the distal 7 centimeters of rectum is retained.

*E. Equivocal result following resection of the sigmoid and rectum with anastomosis 1 to 2 centimeters above the mucocutaneous line.* A 60 year old man (Framingham Union Hospital No. 78221) was found to have an early grade 2 adenocarcinoma of the rectum the lower border was 9 centimeters above the anus. The tumor was 3 centimeters in diameter, involved only about one third of the circumference of the rectum and was freely movable on the underlying tissues. At operation the distal half of the sigmoid and all of the rectum except the distal 1 to 2 centimeters were resected. Anastomosis of the proximal sigmoid and the retained rectum was established by a modification of the "pull through" technique. A transverse colostomy done at the time of the resection, was closed after the anastomosis had been properly dilated and was well healed. After healing was complete the line of anastomosis was found to be oblique, with 2 centimeters of rectum retained above the mucocutaneous line at the anterior commissure and only 1 centimeter above the mucocutaneous line at the posterior commissure.

For 30 years preceding operation, the patient required a cathartic two or three times a week, rarely having a bowel movement without such medication. Since recovery he has taken no cathartics and, two or three times weekly has had normal, soft, formed stools. The urge to defecate has been associated with an abdominal, cramp-like sensation which has given ample warning. Imminent defecation is now associated with a perineal sensation which is quantitatively less than the sensation he had before operation. There is also a qualitative difference in the sensation which he is unable to describe. The external sphincter can be voluntarily contracted with good force and the patient is not conscious of any loss of strength in this muscle. He believes himself to be continent although he makes no effort to control gas.

Preoperative studies of the rectoanal reflexes showed both the internal and external sphincters to respond normally when the rectum was stimulated with a balloon. Postop-

erative studies indicated that the voluntary sphincter contraction compared favorably in both strength and duration with those of many normal individuals. Numerous attempts to elicit the anal reflexes by stimulation of the remaining rectum the region of the anastomosis and the sigmoid immediately above the anastomosis were uniformly unsuccessful. These failures may be related to the mechanical difficulties of applying the stimulus to the small area of rectum that remains. The lumen of the sigmoid immediately above the anastomosis is relatively narrow as compared with that of the remaining rectum while the anastomosis itself contains scar tissue which is quite inelastic. When even the smallest doughnut shaped balloon is distended below the anastomosis it tends to push out through the anus and to interfere with the obturator. When a balloon is distended above the anastomosis it tends to migrate up the sigmoid unless forcibly held in place by traction on the attached catheter and even then appears to cause no stretching of the wall of the contiguous rectum because of the lack of resilience of the anastomosis. It is also possible that this failure to elicit the rectoanal reflexes is related to operative trauma to the afferent nerves arising in the remaining rectum. This seems unlikely because the perineal sensation that accompanies imminent defecation has not been abolished even though it is diminished in intensity and changed in quality. The diminished intensity of the sensation may be explained on the basis that almost complete resection of the rectum has eliminated most of the receptor units in which it arises. The change in quality of the sensation is more difficult to explain. It may be a faulty observation on the part of the patient.

In an effort to secure objective evidence of the persistence of sphincteric continence following operation a saline enema was given. During the injection small amounts leaked out through the anus on several occasions but was promptly controlled by sphincteric contraction. This observation suggested that the sphincter contracted only after fluid had entered the anal canal and thus too late to be controlled. After 500 cubic centimeters had been injected a strong urge to defecate was es-

tablished. When the patient was then allowed to get on his feet about 100 cubic centimeters leaked out through the anus coming in irregular spurts. The remaining fluid was retained for some time after which it was evacuated along with a large quantity of normal stool without difficulty.

At the present time 4 months after closure of the transverse colostomy the functional result in this patient remains equivocal. His ability to retain solid fecal material may well be the result of colonic continence which would have been retained even had the sphincters been sacrificed. Objective evidence of true sphincteric continence has not been obtained although the presence of a perineal sensation when defecation is imminent suggests that functioning afferent fibers are present in the small amount of rectum that remains. Theoretically these fibers should carry the impulses which give warning as to when sphincteric contraction is required. The observations made during and after the enema suggest that in sufficient rectum and therefore insufficient afferent fibers have been retained adequately to initiate the rectoanal reflexes which appear to be essential to true sphincteric continence.

#### SUMMARY AND CONCLUSIONS

- 1 The essential difference between colonic continence and sphincteric continence is again stressed. The relative importance of each type of continence is discussed.
- 2 The results of physiological studies of the anal reflexes in 12 normal adults are presented.
  - A Stimulation of the sigmoid colon by means of an incrementally distended balloon caused no change in the tonus of either the internal or external anal sphincter.
  - B Stimulation of the upper rectum caused the characteristic reflex responses of both sphincters but the responses were feeble.
  - C The closer to the anus the stimulus was applied the more pronounced were the reflex changes of sphincter tone.
- 3 Clinical observations and physiological studies on 4 surgical patients with anastomoses at various levels of the rectum are presented.
  - A Resection of all of the rectum with anastomosis of sigmoid to anus at the level of the



mucocutaneous line resulted in loss of sphincteric continence and the rectoanal reflexes could not be elicited.

B Resection of the sigmoid colon with anastomosis performed at the level of the peritoneal reflection caused no change in rectoanal reflexes and there was no loss of sphincteric continence.

C Resection of the distal half of the sigmoid colon and the upper half of the rectum with anastomosis 7 centimeters above the mucocutaneous line caused no change in the rectoanal reflexes and no loss of sphincteric continence.

D Resection of the sigmoid colon and rectum with anastomosis 1 to 2 centimeters above the mucocutaneous line gave an equivocal result. The rectoanal reflexes were not elicited but this may be due to the mechanical difficulties associated with applying a stimulating balloon to the small amount of rectum that remains. It is probable however that sphinc-

teric continence is diminished to the point where it is of little practical value.

4. An intact reflex arc, with afferent fibers arising in the wall of the rectum and with efferent fibers terminating in the external anal sphincter is essential for the preservation of sphincteric continence. *The rectum is therefore an integral part of the sphincteric mechanism.*

5 The minimal amount of rectum that must be retained for the preservation of sphincteric continence has not been accurately determined. It would appear that at some point between 1 and 7 centimeters above the mucocutaneous line there is a level below which the rectum can not be resected without seriously interfering with the preservation of sphincteric continence.

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# RADICAL EXCISION OF THE INGUINAL AND ILIAC LYMPH GLANDS

## A Study Based upon 450 Anatomical Dissections and upon Supportive Clinical Observations

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THE location, grouping, size, and number of the inguinal and iliac groups of lymph glands are anatomical features of practical interest to all surgeons treating malignant lesions of the lower extremity, pelvis, and perineum, since metastatic involvement of these glands is a common occurrence. Relatively little has been written regarding variation in the location and extent of these glands and of structures associated with them. As a consequence, the surgical procedures which are advocated for their radical excision are likely to be generalized and inexact.

In an effort to establish a more dependable morphological basis for a procedure of choice, the authors studied the number, size, distribution, and fascial relations of the glands, and then sought to devise a technique which would be both surgically feasible and anatomically sound. It is their hope that the presentation of results will be of service in the treatment of malignancies affecting primarily the inguinal and the associated iliac glands.

### MATERIAL AND METHODS

The anatomical observations were made on dissection of 450 anatomical specimens (American whites and negroes, preponderantly male). The records on the superficial inguinal lymph glands were taken concurrently with those on the saphenous venous tributaries which were reported in an earlier issue of this journal (Daseler, Anson, Reimann, and Beaton 1946).

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A life-sized sketch of the subcutaneous veins of the inguofemoral region and the associated glands was prepared in each of the 450 thighs dissected. These have been employed to furnish data on distribution (Table I) and on size. Certain of the specimens representing typical arrangements, were selected for illustration (Figs. 1, 3, 4, and 5; specimens I to VII). The locations of the ten glands most commonly encountered were recorded diagrammatically (Fig. 2).

Having established patterns and relations by these means and following preliminary operating room observation, a technique for excision was further modified through the use of unfixed specimens.<sup>1</sup> Finally, the stages in the surgery were carried out on selected laboratory (embalmed) specimens, the steps being recorded by the artist (Figs. 6 to 8, specimen VIII). Subsequently, the method was employed by the senior author with satisfactory results. In the following account the authors will first present pertinent data on the glands, on related vessels, and on pelvofemoral layers, employing selected anatomic cases; then the technique of surgical extirpation and of repair will be discussed, as aided by the laboratory observations.

### ANATOMICAL OBSERVATIONS AND DISCUSSION

#### I. GENERAL

The inguinal lymph nodes of superficial position are regularly described as being situated in the area bounded superiorly by the inguinal (Poupart's) ligament, inferiorly by a line cross-

<sup>1</sup>The authors are indebted to Dr. Rollo MacCotter of the Department of Anatomy, University of Michigan, for the use of unfixed specimens in the perfection of the surgical techniques.

TABLE L.—ZONAL DISTRIBUTION OF THE SUPERFICIAL INGUINAL LYMPH GLANDS IN 450 EXTREMITIES (compare with Fig 2)

Number	Zone 1 Upper lateral	Zone 2 Upper medial	Zone 3 Lower medial	Zone 4 Lower lateral	Zone 5 Perineal
1	6	43	73	34	379
2	43	183	146	95	66
3	83	344	86	183	
4	33	33		16	
5	93	3	9	3	
6				30	
7					
8	3				
9					

Average 8.5 lymph nodes per extremity

ing the point of intersection of the sartorius and adductor longus muscles laterally by a line dropped vertically from the anterior superior iliac spine and medially by a similar line commencing at the pubic tubercle.<sup>1</sup> However to be more exact in the 450 extremities examined during the course of the present study these glands were in all cases found within the confines of a quadrilateral area bounded as follows superiorly by a line 13 centimeters in

A comment on nomenclature is appropriate here. In standard descriptions all of the glands which occupy the proximal area of the thigh, over the femoral triangle, are termed inguinal. They are divided into two groups by a horizontal line which crosses the thigh at the point of termination of the great saphenous vein in the femoral, those lying above this line are termed the *superficial inguinal nodes* and those below it the *subinguinal nodes*. The latter group is said to consist of superficial and deep sets.

The superficial inguinal nodes lie immediately below the inguinal ligament; the *retroperitoneal subinguinal glands* are placed on either side of the upper part of the great saphenous vein. All of these glands are situated external to the fascia lata. The deep subinguinal nodes, unlike the glands constituting the preceding sets, are placed under the fascia lata, close to the femoral vein. They are described as if the maximal number were three (the lowest situated just below the junction of the great saphenous and femoral veins, the middle in the femoral canal, and the highest, termed the node of Cloquet or Rosenmüller in the femoral ring).

Actually since but few nodes of the total series are in the inguinal region, rarely (as all be described) occurring along the base of the inguinal ligament or cranial thereto, the term *inguinal* is not suitable. And, although the name *subinguinal* would be serviceably descriptive, *femoral* would be wholly defensible. Moreover, the conventional division into *inguinal* and *subinguinal* on the basis of relation to transverse line (at the suprapubic junction) is worse than arbitrary; it is entirely incorrect, since the area, between lower border of the external oblique aponeurosis and the femoral vein, is not inguinal.

As will become apparent through reading of the present authors' text, the nomenclature of Rosenmüller is anatomically sound. It will be followed in the current discussion. The terms *superficial* will be retained, since it is, seemingly everywhere employed. The distinction between *superficial* and *deep* groups is, of course, fundamentally serviceable.

length parallel to and 1 centimeter above the inguinal ligament and beginning medially just above the pubic tubercle medially by a line 15 centimeters long dropped perpendicularly downward from the pubic tubercle laterally by a similar line 20 centimeters in length, dropped from the lateral limit of the superior boundary inferiorly by a transverse line 11 centimeters in length connecting the lower limits of the lateral and medial borders (see esp. Fig 6).

The superficial inguinal glands, with the saphenous vein and its tributaries are situated within the deeper or typically membranous stratum of the superficial fascia of the thigh—the superficial fascia here being two-layered (Fig 1) just as it regularly is in the adjacent inguinal and perineal regions. The glands are covered by the superficial or fatty layer of the superficial fascia (Fig 3). In slightly obese specimens, when some fat occurs in the deeper or membranous layer the lymph nodes and the associated veins occupy the adipose lamella of the layer. But whether fibrous or partially fatty the stratum is easily separable from the subjacent fascia lata (Fig 1).

These superficial lymph glands send their efferent vessels into glands of deeper position, the latter situated along the femoral vessels within the fascial sleeve (fascia lata) of the thigh and into the iliac continuations of these vessels in the pelvis. These deep glands are lodged within the femoral sheath in tissue which passes without interruption into the retroperitoneal (subserous) tissue of the pelvic cavity (McVay and Anson, 1940). Within the pelvis this subserous tissue forms a stratum between the peritoneum and the parietal (obturator and iliac) fascia.

Of the two major sets the superficial offers the more difficult surgical problem, because of the relatively great expanse of their field. The deep glands in being clustered about the iliac and femoral vessels, form simple elongate chains. The two sets will be considered separately.

## 2. SUPERFICIAL INGUINAL GLANDS

a. *Number size.* The superficial inguinal glands vary in number from 4 to 25 (Figs. 5a to 5d). In the present series of 450 lower ex-

extremities 3 715 lymph nodes were encountered an average of 8 25 per extremity In size the individual lymph glands range between the surface area of 10 square centimeters and 0 6 square centimeter The size of the individual glands is usually inversely proportional to the total number of glands encountered in the individual thigh This statement would not, of course be applicable to cases in which the lymph glands were enlarged through malignant infiltration or suppurative involvement

*b Zonal arrangement* According to the system of Rouvière the superficial inguinal lymph glands are divisible into five groups in relation to areas bounded by horizontal and vertical lines for which the point of intersection is the saphenofemoral juncture The area is thus divided into four quadrants and a central, or fifth zone immediately overlying the saphenofemoral juncture (Fig 2) Von Bardeleben has stated that none of the five groups contains regularly more than 3 or 4 glands However as will be described later in the present series specimens were encountered in which as many as 9 lymph glands were present in a single zone (Figs 5a to 5d)

Zone 1 or the superolateral quadrant may contain no glands or as many as 8 lymph glands The individual nodes are usually elongate in an oblique line paralleling that of the inguinal ligament They are likely to be arranged in chain like formation situated slightly distal or inferolateral to the inguinal ligament and along the course of the superficial circumflex iliac vessels (Fig 5a) The lymph glands are more numerous here and more consistently present than in any of the other zones The members of this group of glands are described as receiving their afferent lymphatics from the skin of the upper gluteal region from that of the lateral and posterior abdomen below the level of the umbilicus and occasionally from the penile skin (or the homologous praeputium clitoridis of the female)

Zone 2 or the superomedial quadrant, may be free of glands or may contain them up to the number of 7 nodes They are usually circular in outline and clustered about the terminations of the superficial epigastric and superficial external pudendal veins (Figs 5a and 5b) The lymph glands of this group are said

to receive afferent cutaneous lymphatics from the following areas umbilical and infraumbilical portions of the abdomen, perineum and cutaneous anal area the scrotum the penile skin and praeputium clitoridis the vulva and portions of the external genitalia outside of the hymen and rarely from the glans penis and glans clitoridis (Rouvière) Cutaneous lymphatics from these regions though terminating in the superomedial group of glands have abundant anastomoses across the mid line they may therefore terminate in either the right or left side or in both Von Bardeleben has stated that none of the glands in either the superolateral or superomedial groups (zones 1 or 2) cross or lie cranial to the inguinal ligament The present authors, however have found several specimens in which a gland was situated above the level of the inguinal ligament, but never by a distance greater than 1 centimeter

Zone 3 or the inferomedial quadrant exhibits the same range in number of contained glands (none to 7) They are commonly elongate arranged with their long axes extending in a vertical direction It is in this quadrant that glands are most frequently absent (Figs 5c and 5d) in 173 of 450 extremities (38 per cent) lymph glands were wanting and in only 108 (24 per cent) was there more than one gland present The lymph glands of this group receive afferent lymphatics chiefly from the following source areas skin of the perineum, including the cutaneous anal area scrotum vulva the medial aspect of the thigh, leg and foot rarely from the glans penis glans clitoridis penile skin and praeputium clitoridis The lymphatics draining these regions likewise have abundant anastomoses across the mid line to the glands of the opposite side

Zone 4 the inferolateral quadrant, may contain no glands or as many as 9 These glands may be either rounded or oval in shape When of the latter form they are so placed as to have their long axes extending in a vertical direction They are grouped chiefly about the lateral accessory saphenous and the termination of the superficial circumflex iliac veins (Figs 5a and 5b) The glands in this zonal group receive their afferent channels chiefly from the skin of the anterior lateral, and posterior sur

lateral surface of the thigh, leg and foot from the skin of the medial part of the gluteal region and occasionally from the skin of the perineum.

Zone 5, the central or presaphenous region immediately overlies the saphenofemoral junction (Figs. 5c and 5d). A single inconstant gland was found in this region in 68 of 450 extremities (15 per cent). This central or presaphenous gland may receive afferent lymphatics directly from the skin of the scrotum and penis (including the glans) in the male and the vulva (with the glans clitoridis) in the female. Additionally, it may receive wider perineal drainage as well as channels from any of the other zones.

As a group, the superficial inguinal lymph glands are drained by means of efferent lymphatics chiefly into the external iliac group of glands located along the course of the external iliac artery and vein. However, they may also empty into the deep inguinal glands which are situated beneath the fascia lata in the femoral triangle (see hereinafter).

Examination of statistical data growing out of tabular study of the records indicates that 10 lymph glands occur with great constancy (Fig. 2). The most constant individual gland encountered in the current series is one situated in the angle formed by the bifurcation of the lateral accessory saphenous from the great saphenous vein. This gland is absent in but 13.75 per cent of the cases. In the zone of this constant element, a single gland is present in 60.5 per cent of the cases studied; 2 glands in 22 per cent and 3 in 3.5 per cent. Another gland which occurs quite constantly in the authors' series (in 70 per cent of the cases) is one situated lateral to the lateral accessory saphenous vein and the gland mentioned above. A single gland but occasionally 2 or 3 glands (average 2) are frequently encountered (71 per cent of extremities) in an area from 2 to 3 centimeters lateral to and at the horizontal level of the saphenofemoral junction. A single gland or a chain of nodes numbering up to 9 (average 4) is most frequently encountered along the course of the superficial iliac circumflex vessels. Lymph glands are absent at the customary site of this chain in but 6 of the 450 extremities examined (1.33 per cent). A group consisting of from 1 to 7 glands (aver-

age 2) is almost constantly located medial and superior to the saphenofemoral junction near the pubic tubercle. In this area glands are absent in but 9 per cent of the cases. In 183 cases (40 per cent) 1 gland is present; 2 are present in 144 cases (32 per cent); 3 in 58 (13 per cent); 4 in 15 (3.3 per cent); 5 in 4 specimens (1 per cent); 6 and 7 glands each in but a single case.

Before proceeding further with the discussion it might be well to recall that certain regions of the foot and leg, namely the lateral aspect of the foot, the heel and the posterior surface of the leg may drain directly into the popliteal glands. They are 2 to 4 in number and are located in the more distal portion of the popliteal space along the course of the posterior tibial and small saphenous vessels and near their junction with the popliteal vessels. When malignancies involve these areas, the popliteal as well as the inguinal glands should be excised.

*c. Selected specimens.* In order to establish the extent to which the inguinal glands vary in respect to number, relationship to superficial tributaries of the femoral vein and to group-distribution, seven specimens have been chosen for illustration (Figs. 1, 3, 4a, 4c, 5a to 5d). Each is a pictorial record of a dissection.

#### SPECIMEN 1 (Fig. 1)

Here as is invariably the case, the lymphatic glands are lodged in the deep membranous layer of the superficial fascia in the stratum with the saphenous vein and its tributaries. These structures become visible as soon as the superficial fat bearing layer of the superficial fascia has been reflected; however, for full exposure, enucleation from the tissue of the deep layer is required. That is to say, they are imbedded in and do not merely rest upon the latter layer.

In this specimen the glands are large. Most of them are removed by greater than average distance from the saphenous vein and the fossa ovalis; none ascends to the level of the inguinal ligament. With the saphenous vein they outline a field of quadrilateral form.

The great saphenous vein enters the femoral vein at the distal end of the fossa ovalis as a

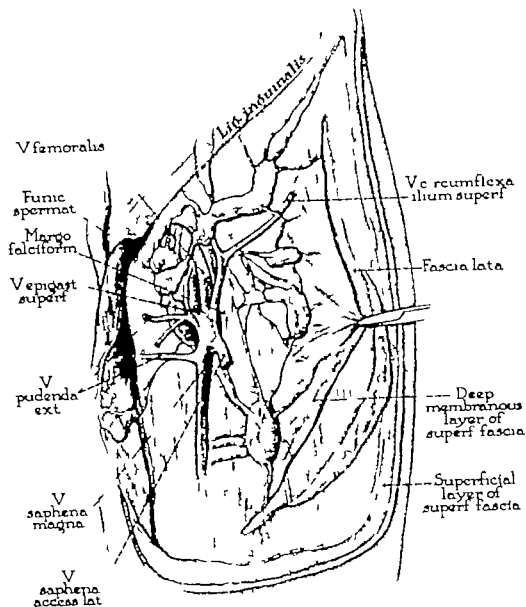


Fig 1. Anterior femoral region, left thigh, specimen I. The superficial layer of the superficial fascia has been removed to reveal the deep layer with its contained inguinal lymph glands and the veins of the saphenous system to which the glands are intimately related. The deep layer has been incised and partially freed from the subjacent fascia lata.

short thick trunk which almost immediately receives large superficial epigastric and superficial circumflex iliac veins. The first of the two external pudendals enters just above the point of confluence of the great saphenous trunk and the lateral accessory saphenous vein; the lower member of the pair terminates by entering on the medial aspect of the great saphenous vein distal to this confluence.

A large oval lymph gland is situated distal to the fossa ovalis lying lateral to and par-

tially covered by the lateral accessory saphenous vein (latter excised in Fig 1 to expose the gland). Two lymph glands, one small and round, the other of medium size and oval, are situated 2 to 3 centimeters lateral to the saphenofemoral juncture. A single small oval gland is located distal to the superficial circumflex iliac vein while a large fused or S-shaped gland lies between this vein and the inguinal ligament. Two medium-sized round lymph glands are located superior and medial to the

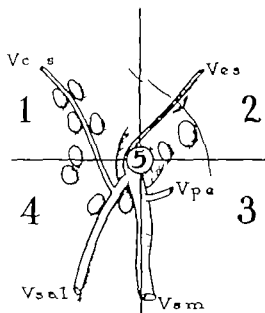


Fig. Saphenous vein and tributaries in relation to the ten inguinal glands of most frequent occurrence. The glands are separable into five groups, four of the groups are bounded by lines which meet at the saphenofemoral junction, the fifth group could lie upon the vessels at the latter junction. 1, Vena circumflexa iliaca superficialis; 2, Vena epigastrica superficialis; 3, Vena pudenda externa; 4, Vena saphena accessoria lateralis; 5, Vena saphena magna. Diagrammatic.

saphenofemoral junction in the angle formed by the superficial epigastric vein (excised in Fig. 1) and superficial circumflex iliac vein. A single large oval gland is situated just medial to the saphenofemoral junction, being crossed on its anterior surface by the first of the two external pudendal veins. A single small oval gland lies 3 centimeters medial to the great saphenous vein and 5 centimeters distal to the level of the saphenofemoral junction.

#### SPECIMEN II (Fig. 3)

On the right side three elongate glands situated in the angle formed by the saphenous vein and its lateral accessory. One large and two small lymph are situated along the course of and phaled to acial circumflex il. A large itly composed o fused no d immediately c saphenofe re h the external p dal emerge sa ovalis and

anterior to the great saphenous vein and its superficial epigastric tributary.

The great saphenous vein enters the femoral deep to the group of large fused lymph glands. On its medial aspect it receives a large superficial epigastric branch while on its lateral aspect it receives the fused common trunk formed by the lateral accessory saphenous and superficial circumflex iliac branches.

On the left side two lymph glands, one of them quite large are situated within the angle of the great and lateral accessory saphenous veins. Three elongate nodes are placed along the course of the superficial circumflex iliac vessels they receive numerous small branches from them. Two small round glands are situated slightly superior and medial to the saphenofemoral juncture. Finally a large slightly curved gland is located medial to the saphenofemoral juncture in the angle formed by the great saphenous and superficial epigastric veins.

The external pudendal artery emerges from the fossa ovalis near its inferior margin and courses beneath the great saphenous vein to accompany the external pudendal vein. The superficial circumflex iliac artery escapes through a small foramen in the fascia lata just inferior to midportion of the inguinal ligament. Several small branches are given off to the adjacent glands as the artery accompanies its correspondent vein.

Near its juncture with the femoral vein the great saphenous vein receives two large tributaries, one on each aspect, lateral and medial. Laterally the tributary vessel is the fused trunk of the lateral accessory saphenous and superficial circumflex iliac veins; the medial tributary is the superficial epigastric vein. The external pudendal vein reaches the femoral vein directly in the fossa ovalis from the medial side.

#### SPECIMEN

At the superior specimen the saphenous vein of the (one large) (Fig. 4a) the superficial femoral

(4a to 4c)

the right side of the glands are situated on the lateral side of the medial on the surface

on the surface of the

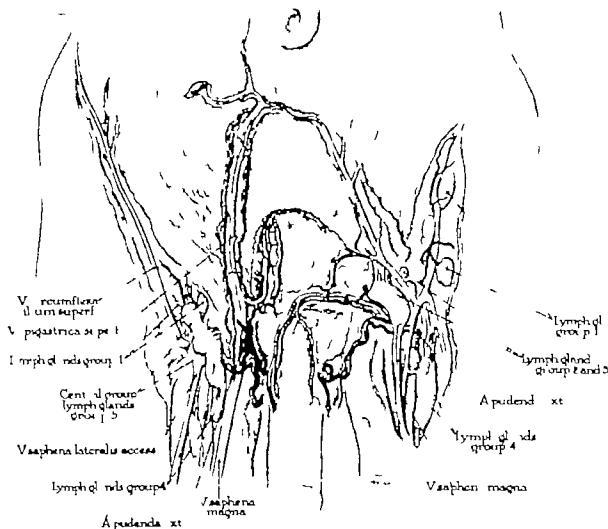


Fig. 3. Anterior femoral and adjacent inguinal and pudendal regions—right and left sides, specimen II. The superficial fatty stratum is here left intact except where it contains lymphatic glands and blood vessels. The vessels have not been transected (as they were in Fig. 1) but exposed *in situ* by removing the immediately surrounding adipose tissue. In this way the extent of the lower abdominal, proximal femoral and pudendal areas of vascular and lymphatic drainage is depicted, and the fascial level of the glands and vessels recorded.

the other two regular branches (superficial iliac circumflex and superficial external pudendal) emerge through small foramina in the fascia lata—each near the area of its ultimate supply.

The saphenous vein enters the femoral deep to the large superiorly placed lymph gland. On its lateral aspect the saphenous receives a large lateral accessory saphenous tributary and small veins from the superficial fascia and adjacent lymph glands. On the medial aspect the saphenous vein receives a superficial epigastric vein and two superficial external pudendal veins—the lower one of which enters by a common stem with a tributary draining the superficial tissue on the adductor side of the thigh.

On the left side at superficial level, are two unusually large glands which almost encircle the saphenous vein at its termination—five lesser glands—two of which extend superolaterally along the superficial iliac circumflex vein are also present (Fig. 4a). Efferent lymphatic vessels leave the upper member of the large pair of glands to gain the pelvis by passing through a small hiatus in the fascia lata situated just distal to the inguinal ligament. The margins of the fossa ovalis—the femoral artery and vein are completely obscured by the lymph glands and the saphenous vein (cf. Figs. 4b and 4c).

A single superficial epigastric and a superficial external pudendal artery arise from the femoral within the fossa ovalis, the superficial iliac circumflex emerges through a separate



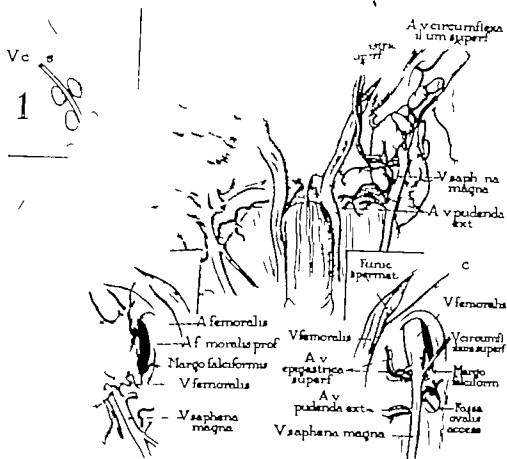


Fig. 4. a, c. Anterior femoral and adjacent regions; specimen III. a, Right and left sides. The bifurcated superficial fascia has been removed to expose the inguinal lymph gland as they lie in relation to the blood vessels. b and c, Right and left sides, respectively, of the same specimen. The lymphatic glands have been removed in order to expose the femoral vessels in the fossa ovalis and the branches of the artery and the tributaries of the vein to which the glands were related.

hiatus just inferior to the inguinal ligament and sends some of its twigs to the lymph glands.

The saphenous vein receives the three regular tributaries (epigastric iliac pudendal) in addition to several small branches from the superficial fascia and adjacent lymph glands.

(On the right side at deeper level (with lymph gland removed) the fossa contained saphenous and femoral vein (Fig. 4b). The regular femoral artery and vein, the femoral artery being located next to femoral vein enters the femoral vein crotch between the femoral and superior aspects and

branch on the lateral and inferior sides. The superficial epigastric artery emerges from the fossa ovalis whereas the superficial circum-

flexual pudendal artery makes nearby through s in

ata.

On the left side at comparable level the

contains the femoral sheath (Fig. 4c)

artery arises from the femoral artery within

to the saphenous vein

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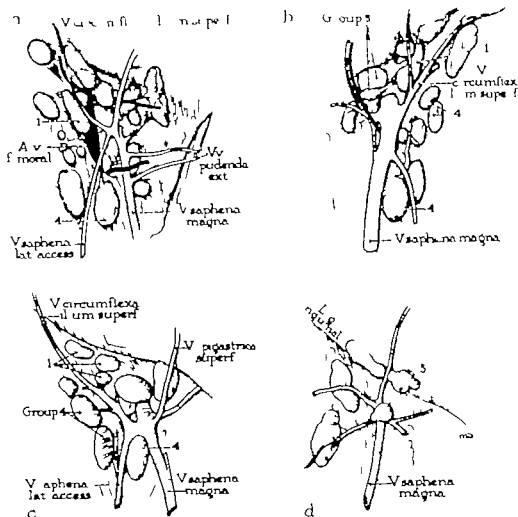


Fig 5 a to d Anterior femoral region Types of arrangement of the inguinal lymph glands specimens IV to VII a, c, and d Right groin b, left groin

beneath the saphenous vein to join the external pudendal vein

#### SPECIMEN IV (Fig 5a)

A single large oval gland is situated within the angle formed by the great and lateral accessory saphenous veins. Another large oval gland is located on the outer aspect of the lateral accessory saphenous vein at the same level as the preceding. A group of six glands, two large and oval and four small and round, are placed 1 to 3 centimeters lateral to the saphenofemoral juncture. A group of three large glands, round and elongate, are located along the course of the superficial circumflex iliac vein. Three glands are situated superior and medial to the saphenofemoral juncture in the angle formed by the superficial epigastric, external pudendal, and great saphenous veins. Two glands are situated medial and inferior

to the saphenofemoral juncture. The first lies deep to the great saphenous vein at its juncture with the upper member of a pair of external pudendal tributaries; the second lies in the angle formed by the inferior member of the pair of veins and the great saphenous vein.

#### SPECIMEN V (Fig 5b)

As in the preceding specimen, a single large gland is located in the crotch bounded by the great and the lateral accessory saphenous veins. Lateral thereto is a gland of approximately the same size. Four smaller glands lie to the outer aspect of the saphenofemoral confluence. A single large gland is situated inferolateral to the superficial iliac circumflex vein, and five nodes lie in the triangular field between the latter vessel and the superficial epigastric vein. A single gland lies beneath the superficial external pudendal vein.



in surface area. In general, the lymph glands in zones 3 and 4 tend to be somewhat larger than those in zones 1, 2 and 5. These differences in size are, however, not constant and small glands are often found in zonal association and either kind may be found in any zone of an individual thigh. The average size of the outline of glands in the several zones is as follows: zone 1 0.75 square centimeter; zone 2, 0.87 square centimeter; zone 3, 1.37 square centimeters; zone 4, 1.75 square centimeters; zone 5, 1 square centimeter in area. The lymph gland which is so regularly located in the angle formed by the great saphenous vein and its lateral accessory branch is consistently larger and more prominent than its mates.

### 3 DEEP INGUINAL GLANDS

*a Number, size* The deep glands are smaller as a lot, than the superficial. Their numbers vary, but usually they form an almost continuous chain separated only for reasons of topographical convenience from the iliac glands of the pelvis.

*b Location and arrangement* The glands follow the course of the femoral and deep femoral artery and vein. This means that they are subjacent to the fascia lata and chiefly in the femoral triangle. They may extend distally into the adductor canal, proximally the chain is prolonged beneath the inguinal ligament to merge with the members of the external iliac set.

The deep glands are lodged in the fatty tissue of femoral sheath. As already described and figured by McVay and Anson (1940), this adipose layer lies within the membranous tube which is regularly described as the femoral sheath. The membranous layer is a derivative of the abdominal and pelvic fascial layers—of the transversus and iliopsoas muscles respectively. It is carried downward into the thigh beneath the inguinal ligament, as the external iliac vessels become femoral (McVay and Anson Fig 5). Within this truly fascial sheath is situated the adipose layer; the latter is a derivative of the subserous (retroperitoneal) layer of the abdominopelvic cavity (McVay and Anson, Fig 7). Housed within this fat-filled stratum of connective tissue the

glands are simply clustered about the femoral vessels (Fig 7). The most constant and usually the largest member of this deep chain of nodes is the gland of Rosenmüller or Cloquet situated in the femoral canal beneath the inguinal ligament and medial to the vein. They are not separable into groups, since there exist neither femoral arterial rami nor corresponding venous tributaries which might serve as dependable boundaries for zones. Moreover local concentrations of glands do not occur; the glands surround the femoral vessels in a scheme of rather even distribution. Consequently, a precise cataloging of their relationships is not possible.

Summarizing these observations, it may be said that the deep glands, in being clustered about the large vessels within the adipose stratum of the femoral sheath are arranged in the form of a chain from one specimen to another they exhibit no marked variation in grouping or important difference in number. Usually they are of small or of medium size.

### 4 ILIAC (PELVIC) GLANDS

The iliac glands are associated with the external iliac, hypogastric (internal iliac) and common iliac blood vessels, and are correspondingly named. Those distally placed are continuous with the nodes of the inguinal set while the glands situated proximally are continuous with the aortic (lumbar) nodes—the three sets being separable only upon topographical basis. In regard to number and position they conform to the standard descriptions.

The external iliac nodes are 8 to 10 in number. The hypogastric usually 8 the common iliac glands 4 to 6. The glands of the three sets are found chiefly along the sides of the vessels. Of the external iliac group a single gland may rest upon the medial aspect of either artery or vein or in the sulcus between the vessels. The hypogastric glands are similarly related to the hypogastric vessels and their larger arterial branches and venous tributaries of the common iliac set 1 or more may be partially concealed by the vessels (i.e., lie dorsal to them) and an equal number appear below the bifurcation of the aorta, upon the fifth lumbar vertebra. All of the iliac and



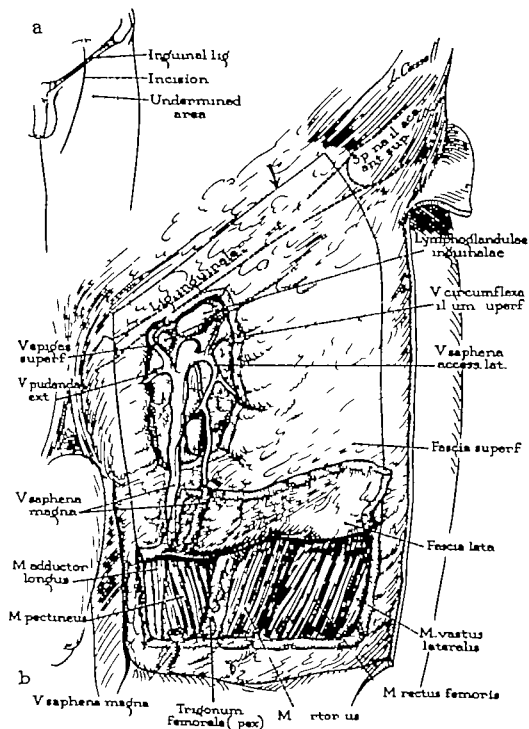


Fig 6, a and b. Technique of surgical exposure of the inguinal lymph glands, carried out on an anatomical basis, specimen VIII. a, Direction and extent of surgical incision. Shaded regions indicate the extent to which skin flaps should be undermined. b, Surgical procedure, continued. Showing the structures contained in the quadrilateral block of tissue excised in the radical extirpation of the glands, and the associated veins and the fascia in which the superficial glands and vesicles are imbedded. The quadrilateral area is outlined, its superior limit marked by an arrow. Proximally, in the area of the fossa ovalis (saphenous opening), the bilaminar superficial fascia has been removed, exposing the deep fascia (fascia lata) distally just beyond the apex of the femoral triangle, both superficial and deep layers have been incised and turned upward together exposing the subjacent musculature.

Continuing in the procedure here illustrated by dissections of selected specimens the skin over the anterior surface of the upper

thigh and lower abdomen is to be excised. Similarly the superficial fascia and the fascia lata are to be removed (Fig 6b block of tis-

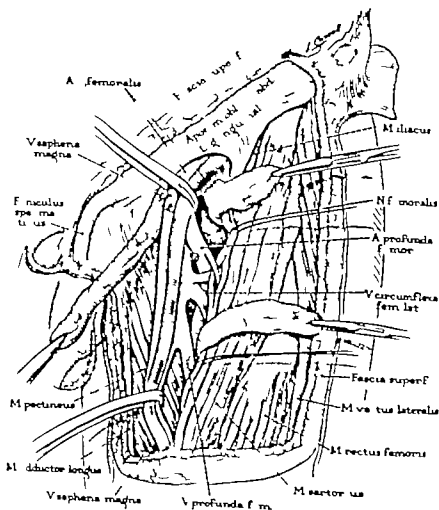


Fig. 7 Procedure, continued, same specimen (VIII) Illustrating the method of removing the deep inguinal glands, by opening the fibrous layer of the femoral sheath and excising the gland-bearing fatty layer (retracted in several portions) which surrounds the femoral vessels.

sus outlined by dotted lines) The quadrangular block is 5 inches wide and 8 inches long. In the region of the fossa ovalis the superficial fatty tissue overlying the great saphenous vein and its tributaries and the superficial inguinal lymph glands, is removed. The dissection is begun at the lower end of the quadrilateral block the great saphenous vein being doubly ligated and severed. Then the incision is carried deeply to the level of the underlying musculature of the thigh. The block removal of these tissues continues in a cephalad direction.

In the next step of the procedure the quadrilateral block of tissue consisting of the su-

perficial and fascial layers with contained saphenous vessels and all superficial inguinal lymph nodes is excised, exposing the underlying musculature of the thigh in the femoral triangle (Fig 7). Beginning at the apex of the femoral triangle, the femoral sheath, with the contained gland-bearing adipose tissue, is progressively removed in this way the femoral vessels their circumflex and deep branches and the femoral nerve are entirely freed of their surrounding fibroadipose tissues. The several muscular rami (to the pectineus, iliopectineus quadratus femoris, and adductor muscles) should be ligated and severed in order to facilitate this phase of the surgical dissection.

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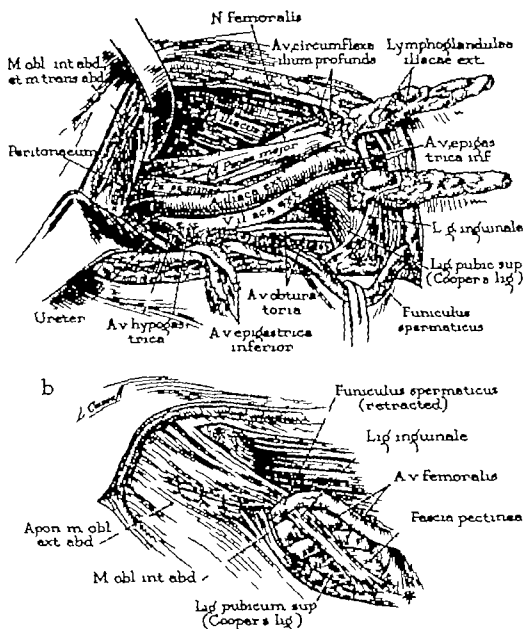


Fig 8, a and b Surgical procedure, concluded same specimen (VIII) Showing the method, a, by which the dissection is carried into the pelvis preparatory to removal of the iliac lymph glands, and the means, b, of closure of the inguinal incision, through utilization of the superior pubic ligament as a line for aponeurotic anchorage. Asterisk in a marks the site of the pubic tubercle, as does the lower asterisk in b upper asterisk in the latter figure is on the anterior superior spine of the ilium.

(deep branches and tributaries demonstrated in Fig 7 by retraction of the femoral artery and vein gland bearing tissue mobilized)

In preparation for the next stage in extirpation the external oblique aponeurosis is cut in the direction of its fibers from the subcutaneous inguinal ring to a point approximately 1 to 2 inches lateral to the abdominal inguinal ring (Figs. 8a and 8b). The spermatic cord (or the round ligament) and the inguinal canal are thoroughly cleaned of the investing connective tissue—in which latter are contained

lymphatic vessels. The transversalis fascia is freed from its attachment to the inguinal ligament and the subjacent iliopectineus and pectineus fasciae. By means of blunt dissection the peritoneum is raised from the lateral wall and floor of the pelvis and retracted cephalad, to expose the common iliac vessels to a point well above their bifurcation and the point at which they are crossed by the ureter. The obturator nerve and vessels on the lateral pelvic wall are also clearly exposed. To facilitate this exposure it is necessary to ligate doubly



and sever the inferior epigastric and deep circumflex iliac branches of the external iliac artery and the corresponding veins. The spermatic cord with the contained spermatic artery, pampiniform plexus and ductus deferens is to be retracted medially by means of a Penrose drain. Starting superiorly near the bifurcation of the abdominal aorta, the investing sheaths of the common and external iliac and hypogastric vessels, together with the surrounding gland-bearing fibroadipose tissues should be stripped away down to the level of the inguinal ligament. The obturator nerve and vessels also made visible, are to be freed of all the fibrous tissue in which they are imbedded. Here care should be taken to avoid injury to anomalous obturator vessels arising from the external iliac artery and vein (see Ashley and Anson 1941).

In closing the inguinal portion of the surgery the hernial technique devised by McVay and Anson (1942) has been successfully employed in the senior author's cases. The fused aponeurotic portions of the internal oblique and transversus abdominis muscles and the underlying transversalis fascia are approximated to the superior pubic (Cooper's) ligament by means of six steel wire sutures (Fig. 8b). This approximation is carried lateralward from the pubic tubercle to the medial edge of the external iliac vein. The external oblique aponeurosis, which was previously split in the direction of its fibers, is next reconstructed in its lateral portion by means of interrupted steel wire sutures. At this stage the deeply situated external iliac artery and vein are clearly visible and the spermatic cord lies free on the anterior surface of the proximal thigh. In completing this repair the spermatic cord should be placed in the trough-like furrow created by approximation of the so called conjoint tendon and superior pubic ligament. The external oblique aponeurosis is then restored above the cord in order to reconstruct the subcutaneous inguinal ring at a point just medial to the pubic tubercle. If the vascular supply to the widely undermined skin flaps appears adequate, these flaps may be ap-

proximated. Penrose drains are placed (to promote drainage) at either end of the incision. If however viability of the flaps appears doubtful then wide excision of the skin flaps is carried out and closure effected through the use of a broad based pedicle flap and a split thickness graft. Postoperative refrigeration has also proved of value in preserving the viability of the cutaneous flaps.

#### SUMMARY

On the basis of an anatomical study of 450 dissection room specimens, data on the size, arrangement and number of the inguinal and associated pelvic glands have been presented, with the object of placing these morphological facts upon schematic and statistical bases. Certain types were found to predominate in relation to regular tributaries of the saphenous vein and to the femoral and external iliac vessels. Additionally several representative specimens have been illustrated and described in detail in order to account more satisfactorily for the anatomical conditions encountered in individual bodies.

A surgical technique has been described together with drawings of the steps involved. This procedure is the outcome not only of the antecedent observations on anatomic arrangement of the glands and associated structures, but also of the actual surgical employment of the selected method.

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# INTRA-ARTERIAL TRANSFUSION

## Experimental and Clinical Considerations

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THE restoration of blood volume and pressure in the treatment of acute hemorrhage and traumatic shock is a fundamental surgical procedure. The rapidity with which this is accomplished will determine in large part the immediate course and prognosis particularly with regard to cerebral function and the prevention of anuria and myocardial anoxia. The procedures currently in use are concerned primarily with replacement of blood volume rather than restoration of pressure which occurs secondarily. The purpose of this paper is to present experimental and clinical data concerning a method for the simultaneous rapid restoration of blood volume and pressure utilizing the intra arterial route of administration.

The administration of fluids intra arterially was reported as early as 1937. Hypertonic solutions of sodium chloride were used in the treatment of shock by Davis and associates. Kendrick and Wakim in their work on dogs found this solution to be deleterious in that the rise of blood pressure was transitory and the animals would not respond to subsequent injections. The intra arterial method for administration of blood was employed with success by I. A. Burillo, his report appearing in a Russian journal in 1939. In this country the intra arterial route for the infusion of plasma and blood was first used by Kohlstaedt and Page upon the suggestion of Colonel Sam F. Seeley, Medical Corps U. S. Army. Their clinical procedure was based upon animal experimentation in which they compared the efficacy of intra arterial and intravenous infusion of blood in experimental shock. Standardized hemorrhagic shock was produced in dogs by

arterial bleeding until a mean arterial pressure of 50 millimeters of mercury was reached. This pressure was maintained for a period of 90 minutes and then cautiously reduced to 30 millimeters of mercury and kept at that level for 45 minutes. In one group the total volume of blood removed was returned intra arterially and intravenously. The results showed a survival rate of 100 per cent for the intra arterial group as compared with 75 per cent for the intravenous group. In a second group in which only half the blood removed was re-infused 75 per cent of the intra arterial group survived whereas only 30 per cent of the intravenous group recovered. Clinically infusion of solutions other than whole blood caused sloughing of skin in the area supplied by the artery presumably due to prolonged ischemia.

Later work by Glasser and Page evaluating prognostic signs in hemorrhagic shock, further demonstrated the efficiency of intra arterial infusion. Moreover they found that when large infusions of blood are required to restore pressure and volume, the prognosis is poor. The same is true for a falling pressure upon termination of the infusion. These authors observed the effect of ouabain upon the survival rate of animals in shock receiving intra arterial transfusion. The increased survival rates with the use of this rapidly digitalizing drug suggests that the drugs of this group might have a beneficial effect upon the myocardial depression seen in prolonged shock (10).

Shaffer has recently reported that in attempting the administration of transfusions intravenously under pressure the needle was occasionally placed within the femoral artery and the infusion completed with no untoward results. Kay and Hacker described the successful use of intra aortic transfusion by direct puncture during the course of an exploratory thoracotomy for control of hemorrhage from a lacerated internal mammary artery.

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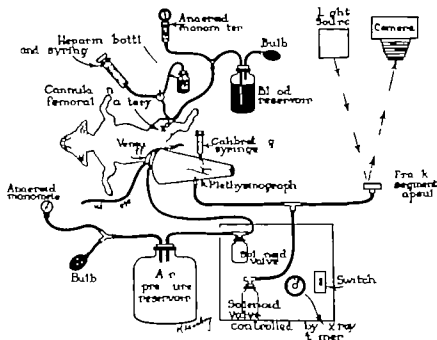


Fig. Diagrammatic sketch of equipment used to measure blood pressure and flow in dogs while state of hypotension is produced. Plethysmograph, solenoid valves for control of cuff inflation and elimination of cuff artifact, and system of optical recording are shown. One limb of the dog is shown with femoral artery cannulated for hemorrhage and reinfusion.

Controlled hypotension by arterial bleeding has been used by Gardner to attain a relatively bloodless field in certain neurosurgical procedures. Blood is removed by cannulation of a peripheral artery and replaced intra arterially at will during or upon completion of the procedure.

In the light of this previous work intra arterial transfusion appeared to have a place in the treatment of shock. Accordingly the demonstration of the effectiveness of the intra arterial transfusion experimentally has led to its clinical application.

The transfusion of blood intra arterially is based upon the hydraulic principles of Archimedes. Under a pressure greater than that of the mean arterial blood pressure an infusion will enter the arterial system. The increased pressure and flow will be conducted throughout the entire system as far proximally as the aortic valves. There will be an immediate increase in arterial pressure and blood volume. Under the conditions of shock, in which there is a lowered blood pressure decreased blood

volume and reduced tissue perfusion an intra arterial infusion will act to restore to normal levels all three deficiencies.

#### EXPERIMENTAL PROCEDURE

In the experimental work with intra arterial and intravenous transfusions, an attempt was made to correlate not only blood pressure changes and visible response with the route of administration but to secure some quantitative measurement of tissue perfusion. Blood flow to an extremity was selected as a criterion for determining changes in the peripheral blood flow on the premise that since this flow is restored late in the correction of hemorrhagic shock, flow to vital centers probably has already been restored.

In the dog blood flow to a hind limb was measured after the method of Eckstein and associates a small air plethysmograph being used the measurements were recorded optically with a large segment capsule (Fig. 1). Arterial blood pressures were recorded optically by means of Hamilton manometers. The

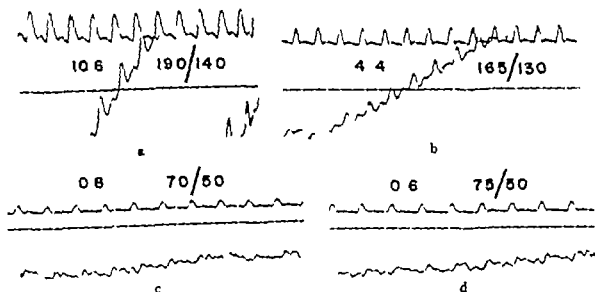


Fig. 2. Blood pressure and blood flow tracings demonstrating progressive vasoconstriction in hemorrhagic hypotension and shock in dogs. Blood pressure is recorded optically using Hamilton manometers; the readings are in millimeters of mercury. Blood flow curves are superimposed on the arterial tracings. The values indicate cubic centimeters of blood per 100 cubic centimeters limb per minute. Time 0.2 second. a, Normal; b, hemorrhage begun; c, shock—10 minutes; d, shock—45 minutes.

following procedure was used: adult dogs weighing 10 to 20 kilograms were anesthetized with intravenous sodium pentobarbital (30 milligrams per kilogram of weight). One hind limb was sealed in the plethysmograph with melted printer's mica compound. The opposite femoral artery was cannulated for controlled hemorrhage, pressure readings, and the reinfusion of blood. In some experiments, other arteries such as the carotid or radial were cannulated for pressure determination. After a basal period of 30 to 35 minutes normal blood pressures and flows were recorded. The animals were then bled rapidly into a bottle containing 2.5 per cent citrate solution until the mean arterial pressure reached 50 millimeters of mercury. The blood pressure was kept at this level by repeated small hemorrhages. During the period of hemorrhage and the ensuing period of hypotension, serial blood pressure and flow measurements were made (Fig. 2).

Hemorrhagic hypotension was maintained for intervals varying from 30 to 75 minutes. At the end of this interval, all the blood removed was reinfused: one group of animals received the infusion by the intra arterial route, another intravenously. In the intra arterial group the blood was reinfused at a pressure approximately 50 millimeters of mercury greater than the mean blood pressure; air pressure

above the blood in the infusion reservoir was used. Infusion rates by this route averaged about 100 cubic centimeters per minute.

The intravenous infusions were allowed to flow by gravity at a rate which was substantially greater than that used in the routine clinical administration of blood, and which was considered to approach the maximum pressure

TABLE I—RESULTS OF REINFUSION OF BLOOD IN DOGS BY INTRA ARTERIAL AND INTRA VENOUS ROUTES

Animal N	Normal values	Time in shock min.	Shock values	Time for recovery min.	Recovery values	Result
<b>Intra-arterial transfusion</b>						
1	6.6 120/105	45	0.8 60/40	10	6.3 125/90	Survived
2	4.4 70/30	75	0.3 55/35	8	5.5 105/45	Died—De.
33	5.16/30	60	0.3 75/55	0	120/100	Survived
53	0.6 100/140	45	0.6 70/30	4	0.3 100/120	Survived
7	13.9 150/0	30	0.3 55/40	7	4.2 0/85	Survived
<b>Intravenous transfusion</b>						
1	6.1 120/100	30	0.6 95/55	15	5.9 115/85	Survived
2	3.4 120/95	60	0.6 55/45	35	6.5 115/90	Survived
6	6.5 125/90	45	4.0 60/50	30	5.8 95/75	Survived
78	2.0 120/90	30	6.5 55/40	15	1.2 120/90	Survived

\*Rapid intravenous infusion, 500 cc. returned in 6 minutes.



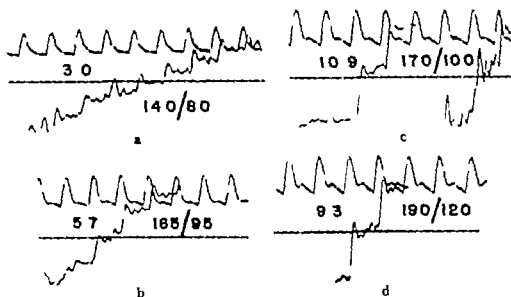


Fig. 4 Restoration of pressure and flow with intra-arterial transfusion in dog—500 cubic centimeters of blood given in 6 minutes. The time required to restore the pressure and flow is 4 to 5 times less than that required by the administration of blood intravenously. a, Intra-arterial transfusion, 2 minute 125 cubic centimeters, b, 3 minutes 300 cubic centimeters, c, transfusion completed, 6 minutes, 500 cubic centimeters, d 45 minutes after transfusion begun

Following intravenous transfusions, recovery was considerably slower, requiring a period approximately four times longer than that required after intra arterial transfusion. There was also a tendency for blood pressure and flow to be maintained at a lower level than normal after the transfusion was completed.

In general these results were in agreement with the more extensive work of Kohlstaedt and Page, but differed in that the period of hypotension in these experiments was shorter and in each instance all the blood removed was re-infused.

All of the animals survived indefinitely except for one which died of distemper 2 days after an intra arterial experiment. No ill effects were observed following either procedure. In one instance (dog 7 Table I) a comparison of the two methods of transfusion carried out several weeks apart on the same animal is afforded.

#### CLINICAL APPLICATION

The clinical application of the intra arterial transfusion at Emory University Hospital and Grady Memorial Hospital has followed the technique developed experimentally by Kohlstaedt and Page. The dramatic results demonstrated in the laboratories on animals in experimental shock led to its introduction clinically.

The apparatus is simple and easily assembled from materials found in any hospital blood bank (Fig. 5). The blood is contained in a 1000 cubic centimeter Kelly bottle from which it flows through a glass Y to the cannulated artery and an aneroid manometer unit. Controlled air pressure from a sphygmomanometer bulb applied above the blood in the reservoir permits the pressure within the entire system to be maintained at any desired level.

The aneroid manometer unit provides an interface between the sterile and unsterile parts of the apparatus, as shown in Figure 5. The sterile rubber stopper with attached finger from a surgeon's glove is placed loosely in the glass tube. A 2.5 per cent sodium citrate solution is poured into the reservoir and allowed to fill the tubing. When the level of the solution has risen to 2 centimeters in the manometer tube the rubber stopper is pressed in firmly. An increase in hydraulic pressure within the system will be transmitted to the air above the solution and be recorded by the aneroid gauge.

The apparatus except the rubber bulb and aneroid gauge, is wrapped as a unit on a tray and autoclaved. Prior to use the entire system is assembled clamped in place with double-end clamps, and filled with citrate solution. Blood is transferred from the collecting bottles by filtering through layers of sterile gauze.

TABLE II.—RESULTS OF INTRA-ARTERIAL TRANSFUSION IN CLINICAL CASES

Case Sex Age	Condition predisposing to shock	Blood pressure at beginning of transfusion	Blood pressure at completion of transfusion	Volume of whole blood transfused— c.c.	Time re- quired for transfusion— mins.	Artery used	Result
F 30	Septicemia with peripheral circulatory collapse			20 phases	20	Radial	Died
F 40	Uterine hemorrhage		90/60	250	5	Radial	Survived
F 30	Cesareanotomy with operative hemorrhage		100/70	1000	40	Post tibial	Survived
F 30	Rupture of aortic aneurysm		100/65	500	20	Radial	Survived*
M 55	Intestinal obstruction, neglected pulmo- nary tuberculosis	40/0	85/50	500	45	Radial	Died
F 40	Placenta previa with hemorrhage		100/75	1000	30	Radial	Survived
M 40	Rupture of aneurysm		130/60	2000	40	Radial	Survived
F 35	Gunsight wound of the abdomen	60/30	130/70	500	40	Radial	Survived
M 40	Secondary hemorrhage in periarthritic abscess		00/40	750	30	Radial	Survived
M 55	Hemorrhage from gastroduodenal stoma	05/30	100/60	500	20	Radial	Survived†
F 30	Nephrectomy for hypernephroma with operative hemorrhage		10/30 100/75	1000 500	40 60	Radial Post tibial	Shut in Survived‡
M 60	Transurethral prostatectomy with post- operative hemorrhage		10/60	500	15	Radial	Survived‡

\* Patient died 3 days later from secondary rupture of the aneurysm.

† Transfusion was given to stabilize blood pressure during an operative procedure in a patient with incipient shock and decreased blood volume.

‡ Patient showed signs of shock 1 hour after termination of the first intra-arterial transfusion.

§ Patient died 5 hours later from secondary hemorrhage.

The radial, dorsalis pedis, and posterior tibial arteries are used most frequently for intra-arterial transfusion. The vessel is exposed and a small longitudinal incision is made in its wall through which the cannula is introduced and directed proximally. A distal ligature is tied to prevent back bleeding. Any type metal or glass cannula of 14 or 15 gauge may be used. Upon release of the clamp behind the cannula the pressure within the patient's arterial system may be read immediately on the aneroid gauge.

Depending upon the pressure noted in the cannulated artery the condition of the patient and the former blood pressure if known the pressure necessary for transfusion can be estimated. In patients with no perceptible blood

pressure the transfusion should be initiated at a pressure of 50 millimeters of mercury. The previously estimated optimum pressure may be reached rapidly in successive increments of pressure.

The rapidity with which the transfusion will flow is dependent upon the differential in pressure between that in the reservoir and the patient's arterial system. As the patient's arterial pressure rises there is a diminution in both velocity and volume of flow through the cannula approaching zero as the pressures equalize. By maintaining a constant head of pressure in the transfusion reservoir the arterial pressure can be controlled within narrow limits.

To date 173 intra-arterial transfusions have been given (Table II). The case reports are

# ROBERTSON ET AL. INTRA ARTERIAL TRANSFUSION

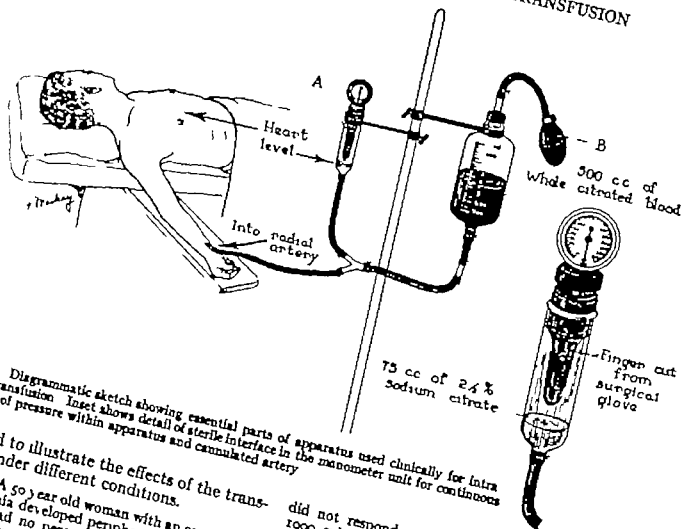


Fig. 5. Diagrammatic sketch showing essential parts of apparatus used clinically for intra-arterial transfusion. Inset shows detail of sterile interface in the manometer unit for continuous recording of pressure within apparatus and cannulated artery.

presented to illustrate the effects of the transfusions under different conditions.

**CASE 1.** A 50 year old woman with an overwhelming septicemia developed peripheral circulatory collapse and had no perceptible blood pressure. Although she was not considered a proper candidate for an intra-arterial transfusion an attempt was made to restore her blood pressure by an infusion of 350 cubic centimeters of plasma in the right radial artery in 10 minutes. The patient showed no improvement and died despite all restorative measures attempted.

**CASE 2.** A 40 year old woman with a submucous leiomyoma of the uterus had lost a large amount of blood prior to admission to the hospital. During her stay in the hospital in preparation for operation she had a brisk hemorrhage from the uterine cavity and developed profound shock with rapid pulse loss of consciousness and no perceptible blood pressure. She received 250 cubic centimeters of blood in the left radial artery in 15 minutes with a dramatic rise in blood pressure to 90/60 and subsequent recovery from shock. A hysterectomy was later performed with no complications.

**CASE 3.** During a craniotomy performed on a 30 year old woman the patient's blood pressure and pulse became imperceptible. With every known measure taken to restore her blood pressure she still

did not respond. An intra arterial transfusion of 1000 cubic centimeters of blood was given via the right posterior tibial artery. Although the transfusion was administered over a period of 40 minutes there was immediate response. The patient's blood pressure rose to 100/70 and her pulse slowed to 130. The operation was successfully completed.

**CASE 4.** Following operation for a patent ductus arteriosus this 12 year old female child developed a mycotic aneurysm. During operation for correction of the defect the aneurysm ruptured. The patient rapidly lost a large amount of blood leading to profound shock. She received 500 cubic centimeters of blood in the right radial artery in 20 minutes with a rapid return of perceptible pulse and blood pressure which became stabilized at 100/65. She survived the operative procedure, but died 3 days later of a secondary rupture of the aneurysm.

**CASE 5.** A 55 year old male known to have active pulmonary tuberculosis was admitted to the hospital with intestinal obstruction of several days duration. He developed increasingly profound shock with a blood pressure of 40/0. During the administration of 1500 cubic centimeters of whole blood via the left radial artery he showed all of the clinical responses to an intra-arterial transfusion in that his blood pressure became perceptible and his pulse and respiratory rate decreased. Skin temperature readings taken on the toes showed a rise of 5 to 10 degrees F.



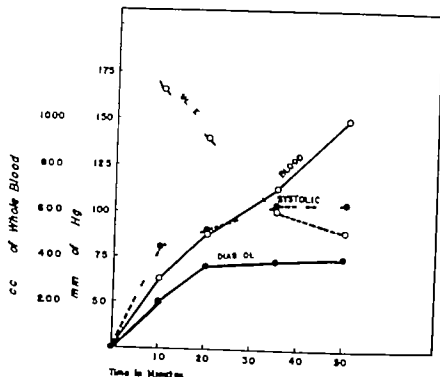


Fig. 6 Case 6. Graph showing relation of quantity of blood transfused to rise in blood pressure and fall in pulse rate plotted on time scale. Intra-arterial transfusion in placenta previa hemorrhage.

However this patient had irreversible changes due not only to prolonged shock but also to pulmonary disease and long-standing intestinal obstruction. After completion of the transfusion in 45 minutes, blood pressure and cardiac output were not maintained and he died approximately half an hour after termination of the transfusion. Necropsy showed pneumonia and gangrenous bowel.

**CASE 6** This 33 year old primipara with placenta previa developed uncontrollable bleeding. An emergency cesarean section was performed to terminate the pregnancy and control hemorrhage. Two 500 cubic centimeter intravenous transfusions were begun but the patient showed no response. She had lost about 3000 cubic centimeters of blood and was in profound shock. An intra-arterial transfusion was begun while the intravenous transfusions were still being given. The patient had responded well by the time 300 cubic centimeters of whole blood had been forced into the left radial artery. She received a total of 1000 cubic centimeters of blood intra-arterially in 30 minutes and survived. Figure 6 gives a graphic representation of the response to the intra-arterial transfusion as plotted on a time scale, showing the pulse rate, diastolic and systolic pressures and the volume of blood infused.

**CASE 7** A 40 year old negro male underwent surgery for ligation of an aneurysm of the left subclavian artery. During the operative procedure the

aneurysm ruptured with severe hemorrhage and an estimated loss of 3500 cubic centimeters of blood. Administration of two 500 cubic centimeter blood transfusions was begun intravenously. Within 10 minutes this patient did not have a perceptible pulse or blood pressure and developed gasping respirations. At this point 3000 cubic centimeters of whole blood were transfused into the right radial artery over a period of 40 minutes. There was a rapid rise in blood pressure which was maintained at 130/60 during the operation and after the procedure was completed.

**CASE 8.** A 36 year old negro female was admitted with a single gunshot wound of the abdomen. She was in shock upon admission, but responded well to intravenous saline and glucose and 1000 cubic centimeters of whole blood intravenously. In the operating room, when anesthesia was induced, the patient's blood pressure dropped suddenly to 70/40. Two intravenous transfusions were started, and after 25 minutes 600 cubic centimeters of blood had been administered. The blood pressure remained at 60/30, with rapid pulse and shallow respirations. An intra-arterial transfusion was begun in the right radial artery and within 15 minutes 500 cubic centimeters of blood had been given, with a rise in pressure to 90/60. In the next 15 minutes the patient received an additional 1000 cubic centimeters of blood and her blood pressure rose to 130/70. The patient sur-

vived the closure of two perforations of the small intestine, and maintained a blood pressure of 130/85 throughout the procedure.

CASE 9. A 46 year old male diabetic, isopropyl alcohol addict was admitted for drainage of the small perinephritic abscess. In the course of 22 hospital days 3 operations were performed under general anesthesia for incision and drainage because of resistant localization. Five days after the third drainage the patient suddenly began to bleed from the operative wound. There was an estimated loss of 2500 cubic centimeters resulting in profound shock. Despite two 500 cubic centimeter intravenous transfusions given as rapidly as possible the patient became moribund with gasping respirations and marked cyanosis. An intra arterial transfusion was begun in the left radial artery while the patient was prepared for a fourth exploration under light cyclopropane anesthesia. A total of 1750 cubic centimeters of blood was given over a period of 30 minutes. The patient rapidly improved blood pressure stabilized at 100/60 the color became good and respirations were deep. A nephrectomy was performed and recovery was uneventful.

CASE 10. A 53 year old negro male was admitted for esophagoscopy because of suspected esophageal stricture. Six years previously he had undergone subtotal gastrectomy for benign peptic ulcer with obstruction. While in the hospital he developed melena which persisted for a month with frequent blood losses of 500 to 750 cubic centimeters and inpatient shock. Roentgenograms demonstrated a partial obstruction of the stomach with spasm. Forty three days after admission exploration for control of the bleeding point was considered imperative. An exploratory laparotomy was performed under continuous spinal anesthesia. The left radial artery was cannulated and intermittent intra arterial transfusions were given throughout the operative period. A total of 1500 cubic centimeters of blood was infused over the two hour period and the blood pressure was stabilized at 100/60. Each time a trend toward a fall in pressure was noted the rate of blood flow into the artery was increased. The patient with critical condition. Surgery consisted of gastrotomy, second anterior gastroenterostomy and establishment of a second enteral except for postoperative intestinal obstruction 7 days later.

CASE 11. A nephrectomy was performed on a 50 year old woman for a large hypernephroma of the right kidney. The kidney and tumor together approximated the size of the patient's liver. Due to the technical difficulties involved in the removal of the mass the patient was under anesthesia for 4 hours. Throughout the operation the patient had frequent extra systoles and manifested shock when over the peritoneal contents were handled. In the course of 4 hours the patient had received 2000 cubic centimeters of whole blood intravenously as

well as 1000 cubic centimeters of normal saline. Toward the end of the fourth hour the patient's blood pressure became imperceptible, the pulse rapid and irregular. An intra arterial transfusion was started in the right radial artery and 1000 cubic centimeters of blood administered within 40 minutes. The patient's blood pressure rose to 110/90 and her condition improved to the point where she was considered to be out of danger. The needle was removed from the radial artery. The artery was ligated and the hour but at the end of this period showed progressive signs of impending shock. She was given 10 cubic centimeters of adrenal cortical extract (25 rat units) intravenously and cardiac stimulants without effect. During this interval, a 500 cubic centimeter intravenous transfusion was given. At the end of the hour the patient's blood pressure was again imperceptible and the pulse thready. A second intra arterial transfusion was begun in the left posterior tibial artery. In the next hour the patient received 1500 cubic centimeters of blood intra arterially at a mean pressure of 120 millimeters of mercury. An additional 10 cubic centimeters of adrenal cortical extract and 0.25 milligram of ouabain were injected intra arterially during the course of transfusion. When the transfusion was completed the patient's blood pressure was 100/75 pulse strong but irregular respirations 20 per minute color good and extremities warm. The patient survived and excreted 800 cubic centimeters of concentrated urine from her remaining kidney during the first 24 hours.

CASE 12. Transurethral prostatectomy for vesical neck obstruction was performed on a 60 year old male. During the course of the procedure arterial bleeding was troublesome and required frequent and extensive coagulation. Within the first 24 hours there was only minimal bleeding. However on the second postoperative day the patient began to pass large amounts of blood through the indwelling catheter with a resulting fall in blood pressure from 140/90 to 60/30, in spite of almost continuous intravenous transfusion. Approximately 60 hours after operation he underwent suprapubic cystotomy for control of the hemorrhage. Blood loss prior to cystotomy was estimated to be 3000 cubic centimeters during the procedure. He had received 6500 cubic centimeters of blood intravenously, a portion of this rapidly using pressure technique. One hour and twenty minutes after cystotomy was begun his blood pressure became imperceptible and his pulse rate 90 but thready. An intra arterial transfusion was started in the right radial artery and 600 cubic centimeters of blood administered at 120 millimeters of mercury in 12 minutes. The blood pressure in the opposite arm was recorded as 90/60. In the course of the next 40 minutes an additional transfusion of 1000 cubic centimeters of blood was given intra arterially resulting in a stabilized pressure of 110/60. The hemorrhage was partially controlled and operation completed. Postoperatively the patient's blood

pressure remained around 110/60 for 5 hours, during which time no further transfusions were given. At this point a profuse hemorrhage occurred in the operative wound, and the patient expired before additional blood could be given.

#### DISCUSSION

The clinical results of intra arterial transfusion have closely paralleled the observations made upon laboratory animals. The pressure responses, the volume of blood needed for response, and the survival criteria are identical as shown in the case histories and in Table II.

The results of our experimental and clinical use of blood transfusion by the intra arterial route have substantiated the premise upon which the earlier investigators worked that is an immediate and sustained response is effected, with rapid rise in blood pressure and restoration of blood volume. A similar result may be secured experimentally with administration of blood intravenously under pressure however the time required for administration and response is considerably longer and the danger of cardiac embarrassment ever present.

With the clinical experience to date, intra arterial transfusion should find a definite place in the treatment of shock. There are however well-defined limitations for its use.

**Indications** Administration of blood by this method is indicated primarily in the treatment of shock resulting from a rapid decrease in blood volume severe traumatic shock which fails to respond adequately to conventional therapy exsanguination in obstetric emergencies, intra abdominal and intra thoracic hemorrhage. Anesthetic emergencies and asphyxia may also respond to intra-arterial transfusion. It is recommended that other measures to combat shock or hemorrhage such as the administration of stimulants, oxygen intra venous infusion and transfusion be used simultaneously.

**Contraindications** Intra arterial transfusion involves the sacrifice of an artery and is a

procedure which should be reserved for extreme emergencies after conventional methods of therapy have failed to effect a satisfactory response.

This procedure does not lend itself to the treatment of the terminal stages of acute or chronic disease in which a response might be only transitory as demonstrated in Cases 1 and 5 (Table II) in which the patients died after an initial response to the transfusion. The wisdom of an intra arterial transfusion in the presence of heart disease or heart failure is debatable.

Active bleeding from a wound peptic ulcer or traumatized organ is not in itself a contraindication for intra arterial transfusion, provided there is a possibility of control of the hemorrhage. It is obvious, however that with this, as with any other procedure for replacement of blood continued or recurrent hemorrhage will vitiate whatever improvement has occurred, as seen in Case 12.

#### SUMMARY

A method for the rapid administration of blood intra-arterially is presented with experimental observations and report of its clinical application in 12 patients. This procedure can be lifesaving in cases of extreme emergency where the outcome may otherwise be fatal because of hemorrhage and shock.

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# URINARY TRACT CHANGES IN CERVICAL CARCINOMA

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IN 1858 Wagner reported the presence of marked ureteral dilatation in one-third of women who died of cervical carcinoma. This paper provided the stimulus for further investigation into the problem of the changes in the urinary tract which result from cervical malignancy. In the early reports most conclusions were arrived at from autopsy material. This was to be expected for pyelography had as yet not been developed, and surgical technique had not progressed sufficiently to afford the surgeon time to make a careful inspection of the urinary system at the time of the operation.

Williams in 1895 presented in the *British Gynecological Journal* his findings in the autopsies of 78 women who died of advanced cervical cancer. In every case there was evidence of renal disease. In 67 per cent he noted the presence of a gross hydronephrosis and hydroureter. Three-quarters of all patients had demonstrable parametrial involvement by carcinoma. Ewing later concluded from an exhaustive study of the problem that the natural termination of most cases of uterine cancer is through uremia by occlusion of the ureters. Graves and Kickham (6) substantiated this statement by Ewing in a study of 600 autopsies. These authors found evidence of ureteral obstruction in 75 per cent of the material examined. This occlusion of the ureter was brought about by the constricting effect of edema and inflammation and by the direct invasion of the ureteral wall by tumor cells. The same authors (7) in a second similar investigation concluded that 78 per cent of patients with broad ligament involvement from cervical cancer had some demonstrable degree of ureteral occlusion.

During the last 15 years as a result of the ever increasing use of radium and x ray in the

treatment of carcinoma of the cervix the etiology of the changes noted in the urinary tract has become a subject of much debate. Several authorities have suggested that the radiation therapy plays a role in the production of scarring and fibrosis of the juxtavesical portion of the ureter which because of its proximity to the cervix is most vulnerable to the effects of the ray. They are of the opinion that it is this scarring and fibrosis which are responsible for the ureteral narrowing which is noted following therapy. These are the conclusions of Herger and Schreiner, Bugbee and others who definitely place the major blame for the development of the hydronephrosis and hydroureter on therapy rather than on the underlying disease. Everett (3) in 1934 reported the changes in 18 patients 11 of whom developed dense ureteral strictures as a result of radiation therapy or carcinoma of the cervix. In the same paper he cited 2 cases of ureteral stricture which followed radiation for benign conditions. Again in 1939 Everett (4), in an article on the effect of carcinoma on the urinary tract concluded that approximately 50 per cent of the patients treated with x ray and radium for cervical malignancy showed evidence of some constricting lesion involving the lower portion of the ureter.

In reviewing the records of the oncological patients at the University of Maryland we too noted the high incidence of urinary tract disease associated with cervical cancer. From this survey we were unable accurately to determine whether the parametrial spread of the carcinoma, or the effects of the radiation were responsible for the urinary tract changes which developed. It was necessary therefore, to investigate a series of patients with the several grades of cervical cancer and to determine exactly the status of the urinary tract before and after radiation therapy. We felt that only through such a plan could the emphasis be placed on the responsible agent. Thirty seven patients compose this present series, repre-

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Fig. 1. Grade 1 Hydronephrosis before treatment as begun.



Fig. 2. Grade 1 Hydronephrosis and hydroureter before treatment.

senting consecutive admissions of new patients with cervical carcinoma to the oncological division of the gynecological department. All patients were treated according to the same plan and all patients have been followed for at least 5 years.

Of the 37 patients comprising this series 31 (84%) were white and 6 (16%) were colored. The youngest was a 25 year old negress with a grade 1 carcinoma, the oldest, a 75 year old white woman with an advanced clinical grade 3 cervical lesion. The average age of the group was 50 years. All patients were married and all but 2 had completed one or more pregnancies. The greatest number of children was 11 and the overall average for the group was 4.

In 11 patients of the group (29%) the carcinoma was confined to the portio of the cervix. Nine patients (24%) had spread of the disease process to the vaginal vaults. The remaining 17 patients (47%) showed unquestionable parametrial involvement and were therefore clas-

sified clinically as grade 3. These statistics suggest that the series, although it was small, represented an average cross section of carcinoma of the cervix.

A detailed history and complete general and special physical examinations were done on the first visit. The carcinoma was graded clinically according to Schmitz. A biopsy of the cervix was taken and a 24 hour report of the tumor made. The microscopic classification used was that of Ewing. The majority of patients in the series received radium therapy before deep x ray. There were only 3 exceptions to this general rule.

We are of the opinion that the technique of radium implantation is a most important factor. For that reason a detailed description of our method is vital to the problem under discussion. Radium implantation at the University of Maryland is an operating room procedure and is generally carried out under sodium pentothal anesthesia. Proctoscopic examina-

tion is done first to rule out the presence of rectal involvement. Following a routine pelvic clean up the patient is carefully examined to determine the pelvic status more accurately. It is this examination under anesthesia that is used in the final clinical grading of the lesion. Thirty milligrams of radium with a 2 millimeter lead equivalent filter are placed in tandem in a flexible rubber sac. This is inserted into the cervical canal. An adhesive tape aluminum foil plaque is made to conform to the size and the shape of the cervical growth. This plaque contains 70 milligrams of radium with a 3 millimeter lead equivalent filter. The tubes of radium are equally spaced by small felt blocks. By this method the distribution of the radiation is entirely uniform. The plaque is introduced in such a manner as to focus the greatest concentration of the ray against the tumor. The bladder and the rectum are protected from radiation by the heavy filters at the extremities of each tube. The plaque is held in place by a large vaginal pack. The pack is inserted meticulously in order to cause the maximum of distention of the vagina. This displaces the cervix and the source of the radiation as far as possible from the bladder and the lower portions of the ureters. The radium is left in place for 30 hours so that a total of 3,000 milligram hours of radiation is given. The same technique is used 3 weeks later to give the second radium treatment. Each patient thereby receives a total of 6,000 milligram hours of radiation. This portion of the therapy is followed in 3 weeks by a course of deep x ray totaling 6,000 to 8,000 roentgen units. All deep x ray is given in divided daily doses through the four standard portals. A second cycle of deep x ray therapy is routinely given 12 weeks later. Throughout all therapy and at regular intervals thereafter all patients are followed by the oncologists.

Before the initiation of any therapy all patients in the series had a complete urological study. This consisted of water cystoscopy at which time a careful inspection of the urethra and bladder were made for evidence of metastatic malignancy, or for the typical cobblestone effect of pressure from an extravesical growth. The ureters were then catheterized with No 6 x ray catheters and complete bac-

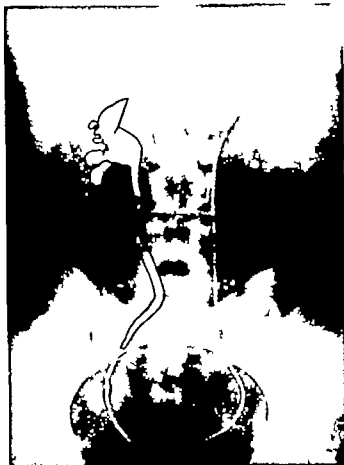


Fig. 3 Grade 2 Hydronephrosis and slight hydroneurter before treatment.

tenological studies made of the entire urinary system. A flat film of the abdomen and a retrograde pyelogram were made by the use of 15 per cent skiodan in gum acacia. The pyelogram was made by the gravity method on the side which showed the parametrial involvement or if none was present, on the right side. The contour of the ureter and kidney pelvis was carefully studied and the transverse diameter of the ureter measured at four locations. These measurements were made uniformly at the level of the ischial spine, the lower junction of the ilium and the sacrum, and at the level of the transverse process of the third and fourth lumbar vertebrae. This same urological study was repeated on each patient 1 year after the completion of all therapy and the two constitute the basis of this report.

Twenty patients (54%) of the group gave some initial positive urological history. 15 complained of nocturia, 4 of dysuria, and 1 of questionable hematuria. No patient complained of urinary symptoms following the first radi-

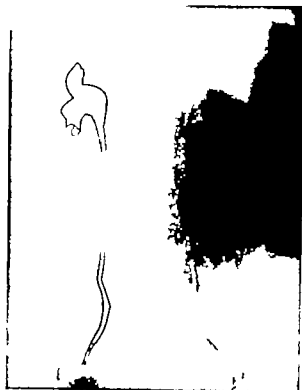


Fig 4 Grade 3 Hydronephrosis before treatment begun.

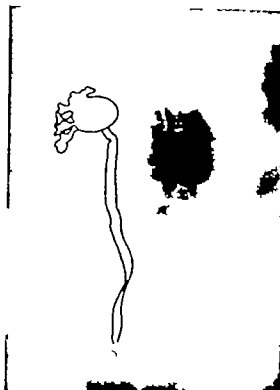


Fig 5 Grade 2 Hydronephrosis and hydroureter before treatment.

um treatment and only 4 had mild dysuria and frequency as a result of the second. These symptoms were transitory and required only a minimum of medication. Five patients had urological complaints following deep x ray therapy and as before all symptomatology was temporary and none suggested bladder disease.

On cystoscopic examination prior to the initiation of therapy 7 patients (18%) had some degree of demonstrable bladder pathology. Two patients showed a mild cystitis. This apparently was in no way associated with the cervical malignancy. In 3 patients there was evidence of elevation of the bladder floor with the cobblestone effect previously mentioned. All 3 patients had advanced cervical cancer with definite parametrial spread of the disease. The remaining 2 patients showed evidence of early metastatic cancer also associated with a far advanced cervical lesion.

By comparison at the repeat cystoscopic study 1 year later only 2 patients (5%) had

bladder pathology. In one patient previously suspected of having metastatic carcinoma the lesion was now quite obvious, and a positive biopsy was obtained. The other patient had developed elevation of the bladder floor. Six patients who originally had some demonstrable bladder lesion showed no evidence of it on the repeat study at the end of the year.

The presentation of a statistical review is at best difficult and at times can be both confusing and boring to the reader. Fortunately this group is small and the points to be discussed are limited to the three major grades of cervical malignancy and the presence or absence of urinary tract pathology.

Of the entire group of 37 patients, 10 (27%) showed some degree of urinary tract dilatation before treatment was instituted. This varied in severity from a very slight hydronephrosis in a patient with an early carcinoma, to an unquestionable hydronephrosis and hydroureter found in 1 of the patients with a grade 3 malignancy. This overall incidence of urinary



Fig 6. Grade 1. Hydronephrosis and hydroureter. No change after treatment. Compare with Figure 3.



Fig 7. Grade 1. Hydronephrosis and hydroureter after treatment. Compare with Figure 1.

tract dilatation is about as would be expected from such a group.

In the series there were 11 patients in whom the cancer was confined to the portio. In 2 of this group (18%) urinary tract dilatation was found. In one patient this was very slight in degree and was limited to the renal pelvis (Fig 1). The second patient showed evidence of a moderate dilatation of both the renal pelvis and the ureter (Fig 2). Of the 9 patients with a grade 2 carcinoma, only 1 showed the presence of demonstrable urinary tract dilatation. This was more marked in the renal pelvis but there was some slight degree of hydroureter associated with it (Fig 3). On examination before treatment, 7 patients (41%) of the 17 with advanced carcinoma and definite parametrial extension showed varying degrees of hydronephrosis and hydroureter. In 3 these changes were confined to the kidney pelvis (Fig 4). The remaining 4 patients showed evidence of both a hydronephrosis and hydroureter (Fig 5).

These findings substantiate the belief that the advanced carcinomas with definite parametrial spread are most prone to be associated with urinary tract dilatations.

One year following the completion of all therapy, each patient was again completely studied and the same urological determinations were done. A meticulous comparison was made of the retrograde pyelograms and the difference carefully noted.

Originally before therapy had been instituted, 2 patients with grade 1 carcinoma had shown dilatation of the urinary tract. The patient in whom a moderate hydronephrosis and hydroureter had been found exhibited no change at the time of the repeat urological study (Fig 6). This patient is living and well more than 7 years after therapy and has continued free of urinary symptoms. The patient who had shown evidence of a slight dilatation confined to the renal pelvis proved on repeat examination to have a dilatation of both the kidney pelvis and the ureter (Fig 7). Asso-





Fig. 9. Grade 2. II hydronephrosis and slight hydroureter. Slight increase after treatment. Compare with Fig. 3.

ciated with this change there was a marked extension of the original carcinoma. Two years later the patient died either of tuberculosis or pulmonary metastasis. Unfortunately no autopsy could be obtained. It is of great significance that no patient with a carcinoma grade 1 developed a dilatation of the urinary tract between examinations.

In the group of patients with grade 2 carcinoma of the cervix one had demonstrable urinary tract changes before therapy. Repeat examination revealed only a slight increase in the degree of dilatation (Fig. 8). Shortly thereafter the patient developed definite pelvic metastasis, for which a third cycle of deep x-ray therapy was given. The patient has remained in *status quo* is living and is free of urological symptoms. Again it is of significance that no patient with a grade 2 carcinoma developed demonstrable urinary tract changes during the time between examinations.

Of the 17 patients with advanced grade 3 carcinoma, 7 originally had urinary tract dila-

tation. Six of these showed no appreciable change in the time between examinations (Figs. 9 a and b). Four of the group are living, and well and all are survivals of 5 years or more. Two patients of the original 7 died, one of advanced carcinoma the other of a cerebral accident. One patient with a grade 3 carcinoma had an increase in the degree of dilatation of the urinary tract. This change was confined to the kidney pelvis and no increase in the diameter of the ureter could be demonstrated. In spite of therapy there was a definite spread of the malignant process, and the patient died 2 years later of carcinomatosis.

In contrast to the patients with grades 1 and 2 carcinoma none of whom developed urinary tract dilatation there were 4 with advanced grade 3 malignancy who at the end of the year exhibited changes which had not been present previously. Two of the 4 patients had definite hydroureter and hydronephrosis (Figs. 10 a and b). These patients have subsequently died in uremic convulsions. In the third patient the dilatation of the pelvis of the kidney was obvious but there was question as to any change in the size of the ureter. This patient died of carcinomatosis. The fourth patient to develop urinary tract pathology in the time between examinations revealed only a moderate dilatation confined to the kidney pelvis. This patient has remained well and free of all symptoms for more than 5 years.

In retrospect we had found that before the initiation of any therapy 27 per cent of the entire group had shown some degree of urinary tract dilatation. Seventy five per cent of those who did show these changes had demonstrable parametrial extension of the disease. By comparison at the end of the survey period 38 per cent of the patients showed some degree of hydronephrosis or hydroureter. At this time 79 per cent of those having dilatations also had extension of the malignancy.

We were impressed by the consistency with which we found the association of urinary tract dilatations and extension of the cervical cancer into the parametrial tissues. A second fact was apparent from this survey, and one which we felt must be taken into consideration in the final analysis. Patients who had grade 3 carcinoma of the cervix were the only ones to de-



Fig. 9. a, left, Grade 3. Hydronephrosis and slight hydroureter before treatment b, No change after treatment. Compare with a.

velop urinary tract dilatations during the time between examinations. And furthermore all patients who exhibited an increase in the hydronephrosis and hydroureter showed a definite spread of the disease in spite of therapy and subsequently died of the malignancy (Table I).

It has been established that scarring and fibrosis are the end results of radiation. This is true of normal and malignant tissue. If the ureter in its course through the pelvis were to receive sufficient radiation to bring about scarring and fibrosis then eventually a stricture would develop at that point of the ureter. This stricture in time would produce dilatation of the upper urinary tract. This is the basis of Everett's (4) belief he had maintained that in time half of the patients treated by  $\gamma$  radiation for cervical cancer will develop some degree of ureteral stricture.

The effect of radiation is directly proportioned to the dose and time, and inversely proportioned to the distance from the source of

the ray. Obviously therefore if we were to eliminate stricture effect from radiation as a cause of the urinary tract changes we had to determine the exact course of the ureter through the pelvis. In addition we had to estimate the exact amount of radiation delivered to all points on the ureter by our particular technique of therapy. Finally we had to know the minimal dose of radiation required to bring about these stenosing effects.

The anatomic position of the pelvic ureter is not constant. The course of the right and left ureter differs quite markedly as a result of the presence of the sigmoid and rectum. However the pars intermedia of the pelvic ureter that portion within Mackenrodt's ligament, is similar on either side. It is through this area that the ureter lies closest to the cervix where for a short distance it is from 1.5 to 2.5 centimeters lateral to the cervix (1). However this distance is altered greatly by the position of the vessels, mostly veins, which surround the ureter on all sides. As the veins from the lower

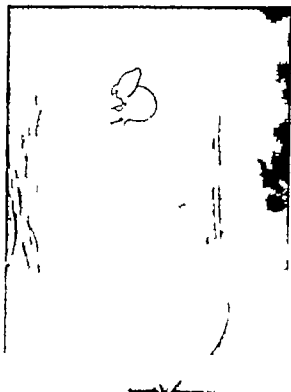


Fig. 8. Grade 1 Hydronephrosis and slight hydroureter. Slight increase after treatment. Compare with Fig. 3.

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Having determined the relative position of the ureters to the source of the ray we next had to learn the amount of radiation delivered to the various portions of the pelvic ureter by our particular method of radium implantation. For this we turned to the work of A. N. Arncson who among others had estimated the distribution of radiation within the average female pelvis. His measurements for the size of the bony pelvis and the viscera were taken from the work of Davis and Williams. Following his technique we plotted the isodose curves of radiation delivered within the pelvis by our method of therapy. Superimposing on these curves the various positions of the ureters as determined by our cystoscopic studies the authors have been able to estimate the dosage of radiation to all portions of the pelvic ureter. From this study we have concluded that at no point in its course through the average pelvis is the ureter subjected to more than 35 to 45 milligram hours of exposure. In those patients in whom the maximum effectiveness of the vaginal packing was obtained the dosage was appreciably less. These patients received as little as 18 to 25 milligram hours of radiation.



Fig. 11. Radium filters before vaginal packing.

TABLE I

Clink No.	Carcinoma grade	Urographic diagnosis		Clinical change after year	Present status
		Before therapy	After year		
Z-96		Hydronephrosis	Hydronephrosis and hydroureter	Parametrial extension	Died. Pul. metastasis
Z-7087		Hydronephrosis and hydroureter	No change	No extension	Living and D
BB-0 30		Hydronephrosis, early hydroureter	Very slight increase	Parametrial extension	Fal
DD-3760	3	Hydronephrosis	N change	N extension	Living and well
BB-4636	3	Hydronephrosis	No change	N extension	Living and well
CC-8 95	3	Hydronephrosis and hydroureter	No change	Parametrial extension	Died. Carcinomatosis
DD-41 4	3	Hydronephrosis and hydroureter	N change	N extension	Died. Cerebral accident
L-9038	3	Hydronephrosis and hydroureter	No change	N extension	Living and well
CC-3330	3	Hydronephrosis and hydroureter	N change	N extension	Living and well
Z 3530	3	Hydronephrosis	Slight decrease	Marked extension	Died. Carcinomatosis
DD- 8 7	3	Normal	Very early hydronephrosis and hydroureter	Marked extension	Died. Uremia
DD 1903	3	Normal	Early hydronephrosis and hydroureter	Marked extension	Died. Carcinomatosis
BB-4076	3	Normal	Early hydronephrosis	Marked extension	Died. Carcinomatosis
CC-4799	3	Normal	Very early hydronephrosis	Questionable extension	Living and well

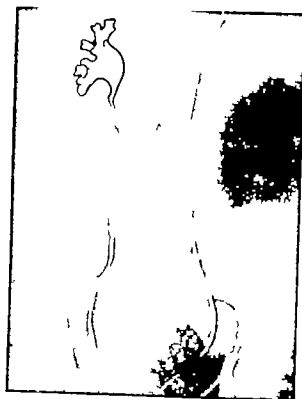


Fig 11 a, left, Grade 3. Normal before treatment. b Hydromegraphia and hydronephrosis after treatment Coopers

uterus and upper vagina anastomose they lie medially and tend to displace the ureter laterally toward the pelvic wall. On its exit from Mackenrodt's ligament the ureter diverges rapidly and enters the bladder obliquely about 15 centimeters below the level of the anterior cervical lip. Most important of all is the fact that the ureter in its course through these areas is held firmly in place by the surrounding vessels and the connective tissue framework.

Upward traction on the uterus increases the distance between the cervix and the ureters a great asset in doing a total hysterectomy from above. If this were not true injury to the ureter as it transverse the ligament of Mackenrodt would be a much more common occurrence. In radiation work the maximum accurate packing of the vagina accomplishes this same effect namely to push the uterus and cervix upward and backward away from the ureters fixed in their beds. On this we believe depends the successful protection of the ureters from the effects of radiation.

To determine accurately the change of distance before and after vaginal packing we have made measurements on operative and autopsy material and on normal patients in the cystoscopic clinic. In the latter group we first passed x ray catheters into the right and left ureters. Using radium filters we made a plaque similar in size to one used in therapeutic application. This was placed against the cervix and a flat film of the abdomen was taken (Fig 11). The vagina was then carefully packed in the routine manner and a second roentgenogram was taken (Fig 12). Measurements were made of the change in distance between the ureters and the cervical plaque before and after packing. In the average case we were able to push the uterus and cervix upward and backward toward the promontory of the sacrum so that the distance of the source of radiation from the most vulnerable portion of the ureter was increased by about 5.5 centimeters. In patients obtaining the most effective packing this increase was as much as 8.5 centimeters.

malignancy and has invariably proved to be a grave prognostic sign

3 The majority of patients with carcinoma grades 1 and 2 did not show changes in the urinary tract before therapy, and none of the patients in these groups developed a dilatation during the period of time between examinations.

4 Urological studies of all patients who have cervical carcinoma are indispensable for purposes of intelligent evaluation and management

5 Radiation therapy will not cause stricture of the ureter if the dosage is not excessive and provided the source of the ray is displaced from the ureter by accurate maximal vaginal packing

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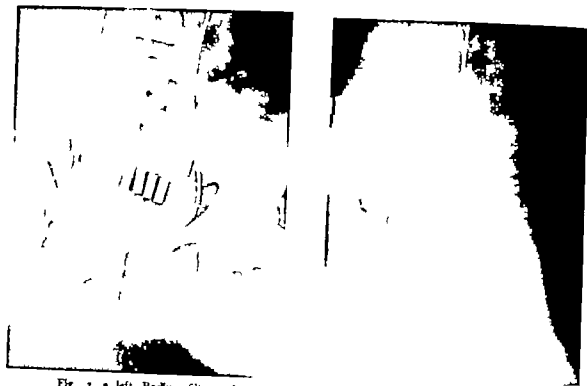


Fig. 2. a, left, Radium filters, after packing b, Radium filters, after packing Lateral view

From these studies we had been able to determine with some degree of accuracy the amount of radiation given to the most vulnerable portion of the ureter. Knowing this dosage we had only to compare it with the amount of exposure needed to cause stenosis of the ureter.

The majority of this work has been carried out in laboratory animals. Martin and Rogers in their work on dogs found that 100 milligram hours of radiation to the abdominal portion of the ureter resulted in a complete stenosis. By back pressure this subsequently caused a hydronephrosis and hydroureter. Doses of less than 50 milligram hours of radiation produced very little if any effect. Demonstrable changes were not noted until after the ureter had been exposed to 75 or more milligram hours of radiation.

A correlation of these studies leads to the conclusion that even with inadequate vaginal packing our method of cervical radiation definitely delivers less than the minimal amount necessary to produce stenosis of the ureter.

These results are in keeping with our clinical studies in which we found that in patients

without extension of the cervical carcinoma into the parametrial tissue a stenosis of the ureter did not develop during the time between the two urological studies. Objection might well be raised on the basis that the 1 year period of time was not sufficient to produce the stenosis necessary for the eventual development of a hydronephrosis or hydroureter. We can best answer this objection by saying again that by our particular method of radium implantation and vaginal packing as previously described even the most vulnerable portion of the ureter receives considerably less than the minimal amount of radiation necessary to cause stenosis.

#### CONCLUSIONS

From these studies we have arrived at the following conclusions:

1. The more advanced the original cervical carcinoma the more frequent is the association of urinary tract dilatation before the initiation of radiation therapy.
2. The development of a hydronephrosis and hydroureter during or after treatment has in every case been associated with advancing

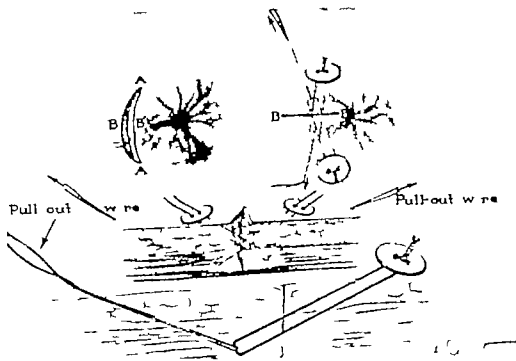


Fig. 1 Drawing of the steps in repair of a defect in the anal sphincter. Upper left, Note the location of the incision and the sulcus in the scar at the site of the defect. Upper right, The steel sutures have been laid and drawn up. The "pull-out" sutures are indicated by arrows. Note how the concentric incision has become radial and the present position of points B and B'. The sulcus has disappeared and is replaced by an invaginating elevation. The lower drawings are detailed cross sections to clarify the method of placing the retention sutures. Note that they are in scar tissue and that the two ends of each "pull-out" suture emerge through a single opening in the skin. Gauze should be placed between the buttons and the skin to prevent erosion.

retention sutures Smiley has reported good results from the use of steel alloy wire as retention suture material in sphincter repair as has Kallett who also used this method.

Some of the reasons for failure in attempted sphincter repair are the following (1) There is a high incidence of wound infection with subsequent dehiscence of the wound. This location is obviously of high potentiality for contamination from the nearby fecal outlet. (2) When large retention sutures are used particularly when placed so that strangulation of tissue occurs a necrotic nidus of infection is formed. Retention sutures that have been described previously are almost inevitably strangulating. (3) Catgut absorbability is rapid in the presence of infection. When it is used as suture material its holding strength is lost before the opposed structures are able to maintain union and separation occurs. (4) The sulcus in the scar between the divided muscle ends as mentioned previously remains after some types of repair. This results in contamination of the close-by operative wound during

the immediate postoperative period of healing as well as in continued leakage or partial incontinence. (5) In the 'classical' repair sutures are placed in poorly holding muscle and may not appose the dissected edges for a sufficient period of time for them to unite firmly. Further the trauma imposed upon the muscle in the course of the operation results in further extension of cicatrization in the muscle.

The method to be described below is based upon Bunnell's principle of "suturing at a distance" with steel alloy wire which he has evolved in the repair and reconstruction of tendons. It has other features which tend to overcome some of the factors in failure enumerated above. No. 34 steel alloy wire is employed. This has a diameter of 0.006 inch and is comparable in strength to a size 10 silk one half diameter greater. It breaks at 7 pounds tension. For greater strength No. 30 or even No. 28 may be used. Its tensile strength is high; it ties smoothly and engenders a minimal tissue reaction. It should never be allowed to kink.



# A METHOD OF REPAIR FOR A COMMON TYPE OF TRAUMATIC INCONTINENCE OF THE ANAL SPHINCTER

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**A**MONG the traumatic causes of incontinence of the anal sphincter are accidental injuries obstetrical injuries operations in the anorectal region and irreparable dilatation of the anorectal sphincteric apparatus. The majority of cases of fecal incontinence occur after anorectal fistulectomy and are usually due to improper or too extensive division of the anorectal ring or to the pernicious practice of postoperative packing. However, a considerable number follow simple incision of an abscess or an otherwise uncomplicated hemorrhoidectomy. The greatest number of defects occur in the lateral quadrants although contrary to common belief in many instances the defect is directly posterior.

The term sphincter mechanism is used advisedly to indicate a more complex structure and action than are comprised by merely the internal and external sphincters commonly mentioned when the anorectal ring is referred to. A clear conception of the anatomic components of the anorectal ring is essential for the surgeon undertaking operative procedures in this region or attempting repair of the already injured muscle.

The extent of injury leading to incontinence may vary from a segmental one to complete destruction or absence of the muscle. The method of repair to be described here deals only with those in which a relatively small segment is lost although it may be modified to apply to larger defects.

Two factors are involved in the mechanism of incontinence. (1) Because of an actual increase in the circumference of the anus the muscle when it contracts, is unable to close the orifice. The interposition of a noncontractile and fixed scar abets the failure of complete closure. (2) Scar tissue in the muscle creates a sulcus interrupting the normal contour of the anal periphery. Because of the puckering

action of the ovoid-shaped elements of the sphincters the anus is normally corrugated, with elevations and depressions alternating about its circumference. When a portion of the muscle is replaced by a scar the epithelium covering it forms a smooth trough through which there is an escape of feces and secretion. This sulcus if not removed may also be the source of contamination of an operative wound external to it.

Many types of repair of the incontinent sphincter have been offered, some of which appear to have met with a gratifying degree of success. Many failures are reported however with most of the methods employed. The so-called classical repair is probably the most widely used, although the literature is not fruitful in reports of its success and the consensus of those who have employed it is not wholly favorable. This method consists in dissecting out the scar tissue and reapposing the retracted muscle ends. Buie has found that in those instances in which packing after fistulectomy has resulted in a wide scar separating the muscle ends simple excision of the cicatrix is sufficient to correct the defect. The muscle need not be reapposed by suture. Blaisdell has developed an ingenious method in which through an anterior incision the muscle is reefed in such a manner that the circumference of the sphincters is decreased. Other procedures are based upon reflection of a section of the anococcygeal portion of the superficial fasciculus of the external sphincter and muscle. For large defects fascial strips which encircle the canal and are sutured to the edges of the gluteal muscles have been described by Wreden, Stone, and McLanahan. The scarred muscle ends may be apposed through a semilunar incision concentric with the anus. This method described by Blaisdell has the distinct advantages of simplicity and of suturing through a scar with high tissue tension. Annular pursestring sutures have been used as

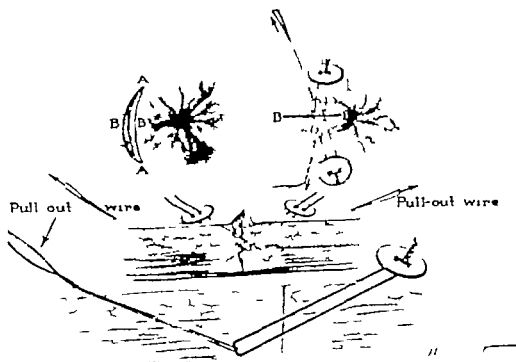


Fig. 1. Drawing of the steps in repair of a defect in the anal sphincter. Upper left, Note the location of the incision and the sulcus in the scar at the site of the defect. Upper right, The steel sutures have been laid and drawn up. The 'pull-out' sutures are indicated by arrows. Note how the concentric incision has become radial and the present position of points B and B'. The sulcus has disappeared and is replaced by an invaginating elevation. The lower drawings are detailed cross sections to clarify the method of placing the retention sutures. Note that they are in scar tissue and that the two ends of each 'pull-out' suture emerge through a single opening in the skin. Gauze should be placed between the buttons and the skin to prevent erosion.

retention sutures. Smiley has reported good results from the use of steel alloy wire as retention suture material in sphincter repair as has Kallett who also used this method.

Some of the reasons for failure in attempted sphincter repair are the following: (1) There is a high incidence of wound infection with subsequent dehiscence of the wound. This location is obviously of high potentiality for contamination from the nearby fecal outlet. (2) When large retention sutures are used particularly when placed so that strangulation of tissue occurs a necrotic nidus of infection is formed. Retention sutures that have been described previously are almost inevitably strangulating. (3) Catgut absorbability is rapid in the presence of infection. When it is used as suture material its holding strength is lost before the opposed structures are able to maintain union and separation occurs. (4) The sulcus in the scar between the divided muscle ends as mentioned previously remains after some types of repair. This results in contamination of the close by operative wound during

the immediate postoperative period of healing as well as in continued leakage or partial incontinence. (5) In the classical repair sutures are placed in poorly holding muscle and may not appose the dissected edges for a sufficient period of time for them to unite firmly. Further the trauma imposed upon the muscle in the course of the operation results in further extension of cicatrization in the muscle.

The method to be described below is based upon Bunnell's principle of 'suturing at a distance' with steel alloy wire, which he has evolved in the repair and reconstruction of tendons. It has other features which tend to overcome some of the factors in failure enumerated above. No 34 steel alloy wire is employed. This has a diameter of 0.006 inch and is comparable in strength to a size in silk one-half diameter greater. It breaks at 7 pounds tension. For greater strength No 30 or even No 28 may be used. Its tensile strength is high; it ties smoothly and engenders a minimal tissue reaction. It should never be allowed to kink.

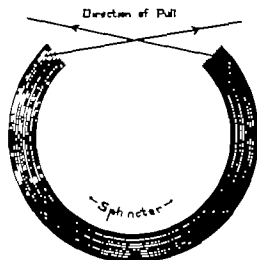


Fig. Diagram 1 illustrates the direction of pull of the retention sutures.

The patient is prepared preoperatively with oral administration of nonabsorbable sulfa drugs cleansing enemas, and a nonresidual diet. Transsacral anesthesia is preferable. The prone jack knife position is used. The anal canal is packed with an antiseptic saturated gauze and carefully draped out of the operative field. Atraumatic aseptic technique is observed. A crescentic incision just lateral to and centered over the defect is made and carried down to the required level. Excessive scar is removed en bloc. The dissection is not carried back to normal muscle but rather the muscle ends are allowed to retain enough scar so that sutures may be firmly placed in scar tissue. It must be borne in mind at this point that the entire defect in the anorectal ring which may include the levator and the longitudinal muscle of the rectum the internal sphincter and the two deeper bundles of the external sphincter must be identified.

The steel wires are then laid as shown in Figure 1 being passed through the loop of the pull-out wire. Note in Figure 2 that the direction of pull is tangential to the circumference of the muscle i.e. the end of the muscle to be apposed is held in direct line with its fellow which is, in turn, fixed in the same manner. The 'pull-out' suture (illustrated in Fig. 1) is looped through the end of the holding suture and brought out through the skin with

both of its ends threaded through the eye of a single needle. Thus, both ends of the "pull-out" suture emerge through a single opening in the skin. The steel sutures are then drawn up sufficiently to convert the longitudinal wound into a transverse one, and the defect is closed in layers without tension. The author prefers the use of fine interrupted cotton sutures. The retention sutures are secured to the surface of the skin with buttons and tightened. Several layers of gauze are placed under the buttons to avoid pressure ischemia of the skin. When the operation is completed it will be observed that the longitudinal wound has been converted into a transverse one and that the sulcus referred to becomes a fold invaginating itself into the anus. Thus the normal corrugations of the anus are restored. No bowel movement is permitted for at least 7 days. The sutures are removed at end of 14 days.

This procedure has been employed upon three occasions with good results.

#### SUMMARY AND CONCLUSIONS

Failure often follows attempts at repair of the incontinent anal sphincter for a variety of reasons.

A method of repair is described which requires minimal dissection, converts the ditch-like defect into an elevation simulating the normal contour of the anus, obviates strangulating retention sutures and provides sufficient suture traction in the proper direction.

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# TUBERCULOSIS OF THE CERVICAL LYMPH NODES

## The Present Surgical Status

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**T**UBERCULOSIS of the cervical lymph nodes was a common disorder of childhood until about 1920 and its surgical treatment was firmly established. Dowd who wrote extensively on the subject reported nearly 700 personal cases in 1916. Shortly thereafter the incidence began to decrease so that Hanford in 1933 could report on but 131 cases treated surgically. In England there was still a considerable number of cases and up to the time of the war the arguments for and against surgical treatment of tuberculous cervical lymphadenitis were published in the British literature by Thompson, Barrington Ward, Turner, Franklan, Evans and others.

Certain significant changes have taken place to alter the incidence of this disease since Dowd compiled his series of cases.

First, tuberculosis in dairy herds has almost been eliminated thus removing bovine tuberculosis as a factor. This is often mentioned but it was not a major consideration even in 1906 when Park examined a representative group of Dowd's cases and found that bovine tuberculosis accounted for only about 30 per cent of the cases.

Second, the widespread removal of tonsils and the replacement of the old guillotine operation by enucleation of the tonsils removed an important portal of entry, not only for tuberculosis but also for pyogenic infections which lessen the resistance of the nodes to lymph borne or hematogenous infection with tuberculosis. As the nodes draining the nasopharynx are usually the first involved this probably has some significance.

Third, the great decrease in tuberculosis generally has vastly diminished the chances for exposure. In 1915 a positive tuberculin test in a child over 2 years of age was not con-

sidered of great significance but in 1948 a positive tuberculin test at any time in childhood has considerable diagnostic weight. This is undoubtedly the most important factor in the decreased incidence of lymph node tuberculosis.

With so few cases encountered it is natural that the good surgical results of other years should be forgotten. Pediatricians (and many surgeons as well) are prone to consider the surgical treatment of accessible tuberculous lymphadenitis as ineffectual, dangerous and disfiguring. For that reason every other form of treatment is tried first and the surgeon called only when a cold abscess is about to rupture. This concept is ridiculous. Surgical treatment, though differing from other neck dissections, can still produce the best results in properly selected cases, particularly if operation is performed before cutaneous sinuses have developed, and operation certainly need not be disfiguring.

Tuberculosis of the cervical lymph nodes may occur at any age but is predominately a disease of childhood. It is not frequently associated with active pulmonary tuberculosis and is present in only about 5 per cent of the patients admitted for tuberculosis to the pediatric tuberculosis division at Bellevue Hospital. Among adult patients the association is even much less. There were but 20 cases among 2,778 admissions for tuberculosis to the adult service at Bellevue in 1945, and at the New York Municipal Sanatorium at Otisville there were only 19 among 3,998 admissions from 1940 to 1948. Nevertheless every case of lymph node tuberculosis should be subjected to a thorough search for tuberculous foci elsewhere. While the nasopharynx may be the portal of entry it is quite probable that the neck nodes draining this area are infected by way of the blood or lymph streams from an infection originating in the lungs which may

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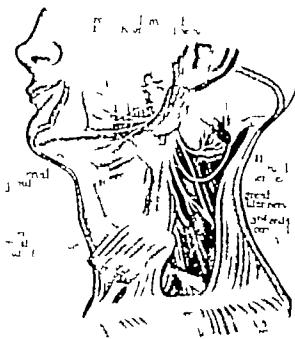


Fig. Imports anatomical structures in the neck. The marginal mandibular branch of the facial nerve is often little lower than depicted here. The seventh cranial nerve usually traverses the sternomastoid muscle. It is exposed in the picture making its course more evident. The nerves of the cervical plexus are sensory and motor cut without danger.

be healed merely deliquescent or possibly active.

The pathology of lymph node tuberculosis need not be recounted. There are several features which should be mentioned however. Lymph node tuberculosis has an acute phase which corresponds to the exudative phase of pulmonary tuberculosis. Fibrous tissue around the nodes perilymphadenitis is a prominent feature of the disease. Liquefaction follows caseation and appears first within the node capsule from which it may rupture into the surrounding tissue to form a cold abscess and thence through the skin to form a sinus.

The clinical diagnosis offers little trouble. A firm swelling in the neck usually starting beneath the angle of the jaw which is tender at first but later painless and tends to extend rather than subside is probably tuberculous. An acute infection in the same location sub-

sides or suppurates in less than a month. The lymphomas feel more elastic and while they may present a massive swelling give the impression of being more discrete. The congenital cystic structures are stationary do not tend to extend and have typical locations.

Treatment of tuberculous lymphadenitis is determined by a consideration of the clinical and pathological situation in any particular case. In the exudative phase of the disease, i.e. while the nodes are tender and the patient toxic bed rest and all the supportive treatment applied to pulmonary tuberculosis are indicated. This is especially true when the lymph node infection is merely a local manifestation of a systemic disease. To operate at such a time would only activate or accelerate the disease elsewhere and should not be done except in those rare instances in which the lymph node disease is having a deleterious effect on the systemic disease. Ultraviolet radiation a popular form of treatment at one time is probably of little real value and may do harm in the presence of a pulmonary lesion.

Röntgen therapy has a wide vogue. Unfortunately it is used in a haphazard fashion without due regard to its limitations but when indicated it is a valuable adjunctive treatment. It cannot destroy the mycobacterium tuberculosis and is in no sense a sterilizing procedure. Nor can it cause the disappearance of a cold abscess or of caseation necrosis. Its chief effect is to produce fibrosis which is the method by which the body combats the infection. It is therefore of value early before caseation necrosis has developed and late when cold abscesses drain through chronic sinuses. Its use should be reserved to these indications and it will then be of great value. To continue irradiation of caseous nodes or of cold abscesses submits the patient to useless irradiation.

Streptomycin has recently come to the fore as a treatment for various types of tuberculosis but little has been written of its use on tuberculous lymph nodes except in a limited number of cases in the government hospitals of the Army Navy and Veterans Administration. Here the reports are equivocal in that some nodes seemed to get smaller while others were unaffected. In no instance was the dis-

case eliminated. Its use on tuberculous sinuses however, has been strikingly good and most of these have healed under streptomycin therapy.

In considering streptomycin therapy certain facts must be borne in mind. First the drug practically always produced toxic symptoms if given in the original dosage for a time adequate to produce therapeutic results. The smaller dose now employed has eliminated much of this trouble but it is always a possibility. Second when the drug has been given for a variable length of time the organisms in the lesion are found to be streptomycin fast. Whether this is due to the development of resistance in the organism or to the destruction of all the nonresistant strains leaving the resistant strains to take over makes little difference to us. Streptomycin can be used for only one full therapeutic course after which it loses its efficacy. Third the drug is most effective in the acute exudative phase of tuberculosis and of scant value, or none at all in the caseous and fibrotic phases of the disease.

Thus we do not advocate streptomycin as a therapeutic agent in the treatment of tuberculous lymphadenitis. Because caseation and fibrosis are prominent features in the disease streptomycin cannot be expected to produce favorable results. At the same time the use of streptomycin produces resistance in the infecting organism so that it will be without value in the treatment of an acute flare-up of the disease should this ever occur. We do advocate its restricted use as a prophylactic measure with surgery to prevent the spread or activation of the disease elsewhere.

The 12 cases in which we have used streptomycin have been in this category and in 11 of them the result was satisfactory. The 1 patient in whom the result was unfavorable had already had a long course of treatment with streptomycin for mediastinal nodes and was presumably streptomycin resistant. One case was particularly interesting in that the child had quiescent lesions in bones and lungs which would ordinarily interdict operation. With prophylactic streptomycin the mass of broken down nodes in his neck that were retarding his recovery was removed without reactivation of any of the lesions and his improvement

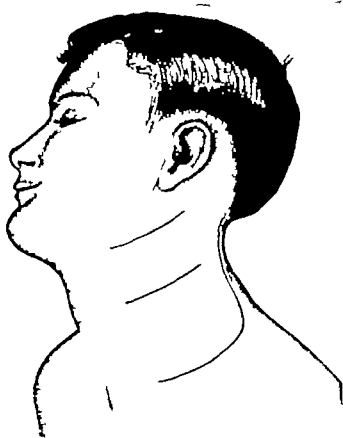


Fig. 2. The common incisions. The lowest is seldom used but if this amount of exposure is necessary it leaves less scar than one along the sternomastoid.

thereafter was rapid. One patient had multiple sinuses outside the area of operation which healed while streptomycin was being given.

In using streptomycin prophylactically our aim is to use enough to prevent reactivation or spread of the lesion but at the same time to avoid toxic symptoms and the production of an organism resistant to the drug. The daily dose of the drug is 10 milligrams per pound of body weight up to 1 gram given in four divided doses. It is started the day before operation and discontinued not later than 2 weeks after operation. If the likelihood of spread seems small it is discontinued on the eighth day after operation. In this way toxic symptoms are avoided and we hope that the organism has not become drug fast. We have not yet had occasion to find out by direct observation.

With all the new modalities for the treatment of accessible tuberculous nodes the treat

ment of choice is still their *complete* removal in properly *selected* cases. Dowd and Hanford have shown this in the past and it is just as true today. Anything less than complete removal is inadequate. Aspiration or drainage of a cold abscess even with curettage of the caseous node is not complete removal. Careful selection is also essential. Operation in the acute phase is not to be considered any more than operation for pulmonary tuberculosis while the lesion is exudative. Nor is operation to be considered when the nodes are only the local manifestation of a systemic infection. To operate in such a situation is both futile and dangerous. Therefore every case must be studied by x ray, blood count and sedimentation rate and by any other means necessary to rule out active lesions elsewhere.

The ideal time for operation is while the nodes are still relatively discrete. The formation of a cold abscess in the tissues around the nodes adds to the difficulty and the formation of a cutaneous sinus further complicates the situation. In neither instance is operation contraindicated provided the other conditions are favorable.

One of the objections raised to the surgical treatment of cervical lymphadenitis is the possibility of damage to important structures in the neck chiefly the motor nerves. This is much more apt to happen in the presence of cold abscesses but can be avoided even then. For that reason it is important that the surgeon familiarize himself with the important anatomical structures in the neck, especially the marginal mandibular branch of the seventh nerve and the eleventh nerve. Figure 1 shows these structures.

The marginal mandibular branch of the seventh nerve crosses the angle of the mandible and lies just caudad to it as far as the facial vessels where it ascends onto the face. It lies beneath the platysma and on the deep cervical fascia. An incision a finger's breadth beneath the mandible will avoid it and if it is necessary to dissect upward the dissection must hug the capsule of the node. If injured it paralyzes the quadratus labii inferioris and interferes with puckering the mouth or smiling.

The eleventh nerve leaves the skull through the jugular foramen crosses the transverse

process of the atlas under the posterior belly of the digastric, and enters the upper third of the sternomastoid muscle to emerge at about the middle of the posterior border to supply the trapezius. It can be injured anywhere along its course. The landmark to use is the transverse process of the atlas and great care should be used when dissecting under the sternomastoid in this region. Nodes frequently surround it and every structure should be identified before it is severed. The nerve is fairly large and with care should always be identified.

The internal jugular vein is frequently surrounded by diseased nodes which must be dissected from it. The vein may be damaged but usually brisk venous bleeding comes from a tributary severed near the jugular vein and not the vein itself. This type of bleeding can be controlled by temporary packing. If the internal jugular vein is damaged it does no harm to ligate it.

Either is the anesthetic agent of choice administered through a nasal catheter or pharyngeal tube. This allows the anesthesiologist to keep out of the way. The use of a tube within the trachea is to be avoided. The trachea of a child is small and the manipulation of the surgeon in dissecting the nodes in the vicinity causes the tube to traumatize the trachea. Tracheitis is usual after the use of the endotracheal tube and in one of our patients tracheotomy was necessary.

Incisions should be made in or parallel to natural creases of the neck as shown in Figure 2. Longitudinal incisions heal with a broad scar which is unsightly. They are seldom necessary but should they be they are best made by extending a transverse incision upward next to the hair line as shown. The scar is less noticeable in this place. If a cutaneous sinus is present it should be excised in one of the standard incisions.

It should be stressed that the cardinal principle in the operation for the removal of tuberculous cervical nodes is the complete removal of all the diseased nodes. There is always much perilymphadenitis present which can effectually hide many diseased nodes. Before terminating the operation careful search should be made for these by palpation and by

direct vision. This cannot be emphasized too strongly. The removal of tuberculous cervical lymph nodes is a slow and tedious process requiring the time and patience to do a thorough job. It is not an operation to be turned over to an inexperienced resident without careful supervision. Diseased nodes left behind in large rather promptly and necessitate a secondary operation for their removal. A certain number of secondary operations are unavoidable but most of them can be prevented by careful removal of the nodes at the time of the original operation.

After the incision has been made as described it is deepened down through the platysma to the node. The fibrous tissue around the node is densely adherent to the capsule and tends to obliterate the cleavage plane which must be defined by sharp dissection. To obtain the proper exposure the node must be grasped in Kocher or in Lahey goiter clamps. More traction must be exerted than will permit the use of an Allis clamp. In dissecting the nodes out we prefer modified curved Mayo scissors with thin narrow tips. The dissection is kept well up on the node as close to it as possible and the adhesions are spread with the scissors and then snipped. This requires sharp scissors which cut to the end (Fig. 3).

Traction on the mass should be relaxed frequently and the adjacent tissues carefully inspected for blood vessels and nerves. Tension empties the veins and makes them indistinguishable until they are cut and bleed (Fig. 3 b and c) and nerves under tension look like fibrous tissue. After working in one direction for some time the operator may find that he is in a deep recess where exposure is poor. The mass should then be attacked from another direction which will make it easier to identify important structures and to maintain orientation.

Cold abscesses are frequently encountered and contamination of the wound by tuberculous pus is of no consequence. If the cold abscess is confined to the node the dissection can be carried on without regard to it. If the cold abscess is in the tissues the wall of the cold abscess must be excised as well as the underlying nodes which are responsible for it. This is a difficult procedure during which in-

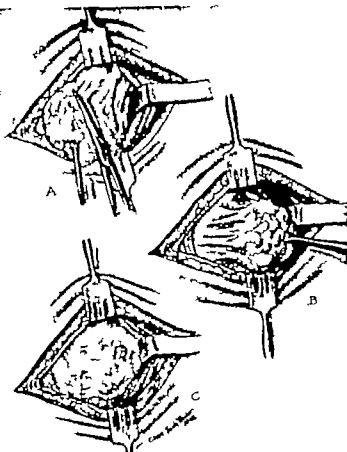


Fig. 3. Technique of lymph node dissection. A. The adhesions to the node are divided well up on the node. B. Traction exposing the adhesions but also hiding a large vessel which becomes apparent when the traction is released as in C.

jury to the nerves and blood vessels can easily occur. If there is a draining cutaneous sinus the same surgical principle holds. With the use of penicillin most of these wounds heal promptly.

The wound is closed by suturing the platysma first and then the skin. We usually place a small piece of rubber dam or a seton of silkworm gut in the wound to take care of the fluid forming in the dead space. This is removed the first day after operation and fluid which collects after that is removed by aspiration through normal skin. The wound should never be probed or otherwise opened unless there is frank pyogenic infection. The patient is allowed out of bed the day after operation, the sutures are removed on the fifth day and the patient discharged the following day.

Complications are chiefly those which have to do with injury to one of the motor nerves and the marginal mandibular branch of the



seventh nerve is the one most commonly injured. When the nerve traverses the wall of a cold abscess it is hard to identify. In such a case it is better to leave part of the wall and trust to streptomycin to heal the wound. Most of the injuries to the seventh nerve are caused by too vigorous retraction and such injuries are of only short duration.

Sinuses and recurrences are complications resulting from incomplete removal of the diseased nodes. Most of them can be avoided by careful surgery but the complications are sure to occur now and then. Recurrent nodes should be operated upon again. Sinuses result from caseous material in the wound usually an overlooked node. The node should be removed but if it is not apparent x ray therapy or streptomycin are potent agents in closing sinuses. Sinuses due to a mixed infection should have penicillin treatment as well. An acute activation of tuberculosis following operation for tuberculous lymph nodes means that an active focus was overlooked before operation. It should never happen.

Results have been uniformly good. Some patients have had to be operated upon again and we have had to use x ray therapy to close an occasional sinus. The antibiotics give us a great advantage which was denied to the older surgeons and if the disease is not allowed to drag on too long before coming to opera-

tion our results should be much better than theirs. This will happen when the advantages of surgical treatment are as well recognized as they were 30 years ago.

#### SUMMARY

1. Tuberculosis of the cervical lymph nodes is much less common than it was in an earlier generation and its character has changed.

2. Surgical removal of the involved nodes is the most satisfactory form of treatment. General hygienic measures and x ray therapy are valuable adjuvants.

3. The judicious use of streptomycin is promising.

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# THE SURGICAL ANATOMY OF CYSTOCELE AND URETHROCELE WITH SPECIAL REFERENCE TO THE PUBOCERVICAL FASCIA

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A LARGE majority of gynecologists and general surgeons believe that there is in the human female pelvis a layer of closely felted fascia which it is alleged is attached to the posterior surface of the body of the os pubis along its lower border and to the cervix uteri a short distance above the external os. Some contend that this layer of fascia is situated just beneath the vaginal mucosa and that it surrounds the vagina while others believe that it separates the vaginal wall from the walls of the bladder and the urethra and that it extends laterally to become continuous with the fascia endopelvina. This layer of fascia has been termed the pubocervical fascia. Synonymous terms are pubouterine fascia, pubovesicocervical fascia and musculofascia.

The group who believe that the pubocervical fascia is an anatomic entity contend that a congenital defect in it or an obstetric injury to it is the basic cause of cystocele and urethrocele. They reason logically therefore that a successful surgical correction of a cystocele or urethrocele depends upon the reconstruction of the defective or damaged part of the pubocervical fascia. It is important to keep clearly in mind the fact that such a concept of the etiology and surgical correction of cystocele and urethrocele is based entirely upon empiric observations made during operations on the living subject or gross dissections on the cadaver.

In view of the fact that authoritative anatomists do not mention the pubocervical fascia and that a considerable number of gynecologists are completely convinced that there is no such fascia in the human pelvis it is important to review the anatomic and histologic facts upon which their conviction is based. It is

obvious that it is possible to form a clear concept of the etiology of cystocele and urethrocele and of the histologic character of the tissues involved in their surgical correction only upon such facts.

To correlate the evidence against the existence of the pubocervical fascia it is necessary to consider (1) the attachments of the vagina, the urinary bladder and the urethra, (2) the histology of the normal vaginal bladder and urethral walls and (3) the normal vesicovaginal and urethrovaginal septa.

## THE ATTACHMENTS OF THE VAGINA

The vagina is attached at its upper extremity to the cervix uteri a short distance above the external os. The muscular coat of the vaginal wall blends with the musculature of the cervix and its mucosa is continuous with the mucosa of the portio. At its lower extremity the vagina penetrates and is attached to the urogenital trigone by its muscular coat. The vaginal mucosa and the mucosa of the introitus are continuous. The anterior vaginal wall above the urogenital trigone fuses so intimately with the posterior urethral wall that there is no line of normal cleavage between them. At a higher level the anterior vaginal wall is loosely attached to the wall of the bladder by a delicate layer of areolar connective tissue which marks a line of natural cleavage between the muscular coat of the vaginal wall and the muscular coat of the bladder wall. The posterior vaginal wall above the urogenital trigone fuses with the upper part of the wall of the anal canal and at a higher level it is attached to the anterior rectal wall by a delicate layer of areolar connective tissue which marks a line of normal cleavage between the muscular coat of the vaginal wall and the muscular coat of the rectal wall. Laterally the vaginal walls are attached to the visceral part of the

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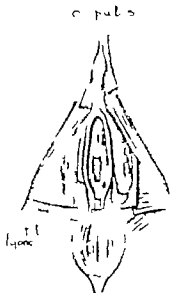


Fig. 1. The urethra and vagina penetrate and are attached to the urogenital trigone below the os pubis. Any layer of fascia which might traverse the length of the anterior vaginal wall or separate the vaginal wall from the wall of the urethra and the bladder would have to be attached at its lower extremity to the urogenital trigone. The term pubocervical fascia, which indicates an attachment of the fascia to the pubic bone, is inaccurate.

fascia endopelvina which is continuous with the vesicovaginal and rectovaginal areolar connective tissue.

#### THE ATTACHMENTS OF THE BLADDER

The ligaments of the bladder are described as true and false under the latter being included the peritoneal folds that pass from the organ to the adjacent abdominal and pelvic walls. From the manifest instability of relations and attachments of the peritoneum incident to distention and contraction it is evident that such peritoneal folds can contribute little to the definite support or fixation of the bladder; hence those parts of the organ possessing a serous covering are movable. The inferior surface on the contrary is comparatively fixed on account of its close relations to the pelvic floor and the presence of *true ligaments*. These are derived from the pelvic fascia which in the vicinity of the bladder presents a stout, glistening band-like thickening (arcus tendineus) that on each side



Fig. 2. Lateral view of the pelvis showing the natural cleavage planes and the penetration of the urogenital trigone by the urethra and vagina below the pubic bone.

stretches from the posterior surface of the symphysis, a short distance above its lower border backward to the ischial spines. On either side of the midline the anterior ends of these tendinous arches pass as strong fascial bands from the symphysis to the bladder as *anterior true ligaments*. After leaving the symphysis the tendinous arches send expansions—the *lateral true ligaments* to the sides of the bladder (Piersol). The posteroinferior surface of the bladder is loosely attached to the vaginal wall and to the uterus by a delicate layer of areolar connective tissue.

#### THE ATTACHMENTS OF THE URETHRA

At its upper extremity the urethra penetrates the wall of the bladder and its muscular coat blends with the musculature of the bladder wall. At its lower extremity the urethra penetrates and is attached to the urogenital trigone by its muscular coat. The urethral mucosa blends with the vesical mucosa and that of the introitus. The anterior urethral wall is attached to the connective tissue in the floor of the space of Retzius. The posterior urethral wall above the urogenital trigone is intimately attached to the anterior vaginal wall. Laterally the urethral wall is attached to the fascia endopelvina.

With the attachments of the walls of the vagina, bladder and urethra clearly in mind

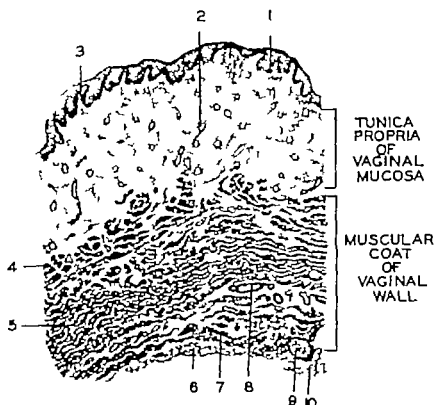


Fig. 3 Longitudinal section of the normal vaginal wall. 1 Vaginal epithelium 2 tunica propria of vaginal mucosa 3 papilla 4 internal circular muscle layer 5 external longitudinal muscle layer 6 fibrous layer 7 interstitial connective tissue 8, artery in muscle 9 ganglion 10, fat lobules. (From Maximow)

MUCOSA OF  
VESICAL TRIGONE 1 2

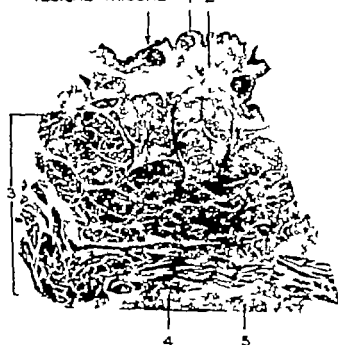


Fig. 4 Section of normal bladder wall 1 Transitional epithelium of vesical mucosa 2 tunica propria of vesical mucosa 3, muscular coat of bladder wall 4, fibrous coat 5 vesicovaginal areolar connective tissue. (From Goff.)

it is apparent that any layer of fascia which might traverse the full length of the vaginal wall or which might separate the vaginal wall from the walls of the bladder and urethra would have to be attached at its lower extremity to the urogenital trigone below the pubic bone (Figs 1 and 2). It is obvious therefore

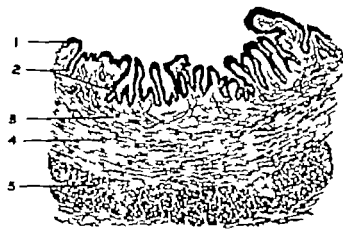


Fig. 5 Longitudinal section of normal urethral wall. 1 Urethral epithelium 2 urethral glands 3 tunica propria of urethral mucosa 4, longitudinal muscular layer 5 circular muscular layer (From Pierkol.)

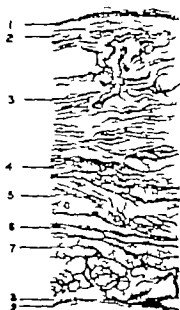


Fig. 6 Horizontal section of the posterior wall of the bladder and the anterior wall of the vagina. 1. epithelium of the bladder, 2. mucosa of the bladder, 3. circular muscle layer of the bladder wall, 4. longitudinal muscular layer of the bladder wall, 5. loose connective tissue, 6. circular muscle layer of the vagina, 7. longitudinal muscular layer of the vagina, 8. mucosa of the vagina, 9. epithelium of the vagina. (From Jacob Henle.)

that the term pubocervical fascia which undoubtedly indicates an attachment to the pubic bone is inaccurate. In behalf of accuracy in the teaching of vaginal plastic surgery it is important to eliminate the term pubocervical fascia and its synonyms from gynecological nomenclature.

#### HISTOLOGY OF THE NORMAL VAGINAL WALL

The normal vaginal wall (Fig. 3) from 2 to 3 millimeters thick, includes a *mucous* and a *muscular coat* supplemented externally by an indefinite *fibrous coat*.

The mucous coat consists of a fibroelastic tunica propria exceptionally rich in elastic fibers and veins. The inner surface of which is beset with numerous conical papillae that encroach upon the overlying epithelium but do not model the free surface. The epithelium from 0.15 to 0.20 millimeter thick is stratified squamous in type.

The muscular coat which directly supports the mucosa without the intervention of a submucous tissue consists of bundles of involuntary muscle that are arranged although not with precision as an inner circular layer and an outer longitudinal layer.

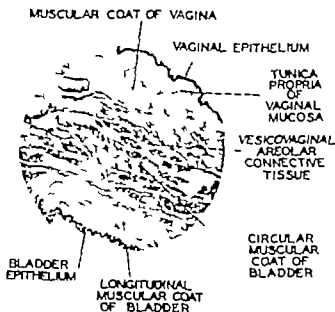


Fig. 7 Low power view of section through the adjacent walls of the bladder and vagina. (From W. Blair Bell.)

The fibrous coat consists of a thin layer of connective tissue which merges into the areolar connective tissue which joins the vagina to the surrounding parts (Piersol) The fibrous coat is in reality a condensation of the vesicovaginal areolar connective tissue

#### HISTOLOGY OF THE NORMAL BLADDER WALL

The normal bladder wall (Fig 4) consists of four coats the mucous the submucous the muscular and the fibrous

The mucous coat varies in thickness with both location and the degree of contraction Over the vesical trigone where always comparatively smooth it is thin measuring only about 1 millimeter where strongly wrinkled by contraction it may attain a thickness of 2 millimeters The mucosa resembles closely that of the renal duct consisting of a fibro-elastic tunica propria covered with transitional epithelium

The submucous coat loose and elastic permits free gliding of the mucous over the muscular tunic when readjustment becomes necessary during contraction It is not sharply defined from the adjoining coats but blends with the stroma of the mucosa on the one side and extends between the tracts of the muscu

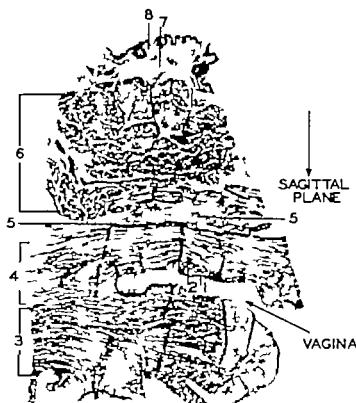
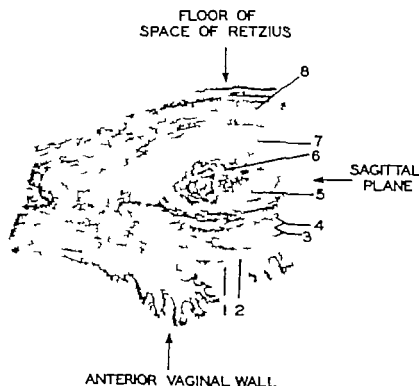


Fig 8. Section through the normal vesicovaginal septum. 1 Epithelium of vaginal mucosa 2 tunica propria of vaginal mucosa 3 muscular coat of posterior vaginal wall, 4 muscular coat of anterior vaginal wall 5 Vesicovaginal areolar connective tissue 6 muscular coat of bladder wall 7 tunica propria of bladder mucosa 8 epithelium of bladder mucosa. (From Goff)

Fig 9. Section through the normal urethrovaginal septum at a level just above the point at which the urethra penetrates the urogenital trigone 1 Epithelium of vaginal mucosa 2 tunica propria of vaginal mucosa 3 muscular coat of vaginal wall 4 muscular coat of urethral wall 5 tunica propria of urethral mucosa 6 epithelium of urethral mucosa 7 muscular coat of urethral wall 8 voluntary muscle fibers of urethral wall. (From Goff)



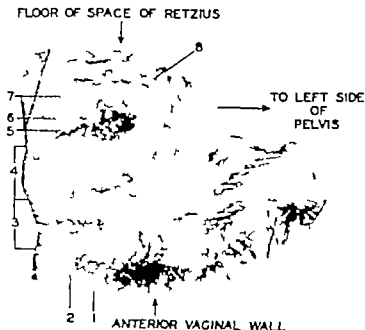


Fig. 6. Section through the normal rethrovaginal septum at level just above the point at which the urethra penetrates the urogenital trigone. 1 Epithelium of vaginal mucosa. 2 Tunica propria of vaginal mucosa. 3 Muscular coat of vaginal wall. 4 Muscular coat of rethral wall. 5 Epithelium of urethral mucosa. 6 Tunica propria of urethral mucosa. 7 Muscular coat of anterior urethral wall. 8 Voluntary muscle fibers of anterior urethral wall. (From William H. T. Addison.)

lar coat on the other. Beneath the trigone a distinct submucous layer is wanting or is replaced by a sheet of muscular tissue.

The muscular coat thicker than the mucous varies according to the condition of the bladder being thin during distention and thick in strong contraction when it may measure as much as 1.5 centimeters. The bundles of involuntary muscle are arranged in two fairly distinct layers—a thin outer longitudinal and a thick inner circular layer. Inside the latter and virtually within the submucosa lies an incomplete additional layer. This innermost layer is represented by isolated and indefinite muscular bundles that are blended with the connective tissue. Over the vesical trigone however this layer becomes condensed and forms a compact transverse muscular sheet that is closely united to the overlying mucous membrane and in conjunction with the muscular tissue of the urethra surrounds the beginning of that canal with a constrictor like tract, the internal vesicle sphincter.

The outer fibrous coat is strongest over the inferior surface where it receives reflections from the fascia endopelvina. Over the posteroinferior surface it blends with the vesicovaginal areolar connective tissue (Peters).

#### HISTOLOGY OF THE NORMAL URETHRAL WALL

The wall of the normal female urethra (Fig. 5) consists of a mucous membrane supplemented by an outer muscular tunic.

The mucous membrane is composed of a tunica propria rich in elastic fibers and provided with a highly developed system of venous plexus covered with stratified squamous epithelium that above resembles the vesical type and below that of the vestibule. Urethral glands are represented by small groups of tubular alveoli that open by minute orifices on the mucous surface. The mucosa is also beset with small pit like depressions into which the ducts of the glands frequently open.

The muscular coat of the urethra comprises intrinsic unstriated fibers and extrinsic striated

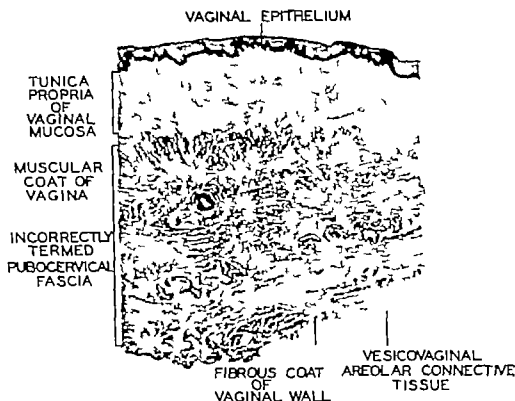


Fig. 11 Section of anterior vaginal wall in a case of large cystocele taken from the lateral part of the wall midway between the urogenital trigone and the cervix.

fibers which are situated outside the unstriped fibers. The unstriped fibers are arranged in an inner longitudinal and an outer circular layer the two being separated by an intervening stratum of areolar tissue (Piersol). The striped fibers are located on the anterior and lateral walls and are absent on the posterior wall—the wall adjoining the anterior vaginal wall. At the extremities of the urethra they form sphincters.

A perusal of the authoritative texts on histology reveals the fact that histologists are unanimously agreed on the histology of the vaginal wall, the bladder wall and the wall of the urethra. In no instance has any histologist described a layer of closely felted fascia in the walls of the vagina, the urinary bladder or urethra. It is apparent therefore that gynecologists who contend that there is a layer of closely felted fascia in the vaginal wall just beneath the mucosa ignore irrefutable histologic facts.

#### THE NORMAL VESICOVAGINAL SEPTUM

Ricca in an exhaustive review of the literature calls attention to the fact that Jacob

Henle in 1866 first described the normal intact vesicovaginal septum. Henle published a hand drawing of a cross section through the intact septum (Fig. 6), in which he illustrates all of the tissues from the vaginal epithelium to the epithelium of the bladder. This drawing clearly demonstrates that there is no layer of closely felted fascia in the vesicovaginal septum. It does show however that there is between the muscular coat of the vaginal wall and the muscular coat of the bladder wall a delicate layer of areolar connective tissue. Referring to this tissue as illustrated by Henle Ricca has stated "His text contains a hand drawing of the microscopy of the *fascia vesicovaginalis*—a loose areolar mesh. Because of the fragile character of this vesicovaginal areolar connective tissue it is not involved in the etiology of cystocele. In the surgical correction of a cystocele its only role is to guide the operator along a line of natural cleavage between the muscular coat of the vaginal wall and the muscular coat of the bladder wall. It cannot be dissected as an individual layer and it cannot be sutured in operations for cystocele. Henle's description of the vesicovaginal



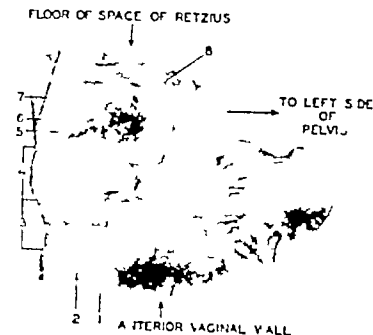


Fig. 2. Section through the normal female urethra. The diagram shows the relationship between the urethra, the vaginal wall, and the surrounding connective tissue and muscle layers. The urethra is shown as a tube passing through the vaginal wall. The surrounding tissue is shown as a dense, fibrous mass. The muscle layers are shown as distinct, layered structures. (From Williams and Harrison, "Anatomy of the Female Urethra," 1910.)

lar coat on the other. Beneath the trigone a distinct submucous layer is wanting or is replaced by a sheet of muscular tissue.

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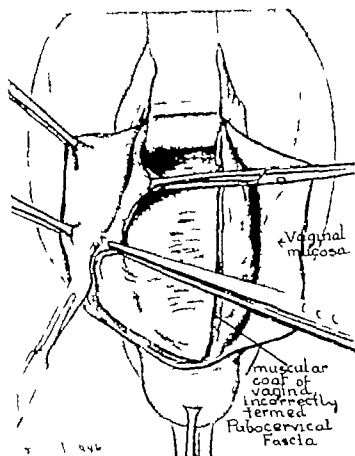


Fig. 14. Operation for cystocele (Type 3). Step 1: The vaginal mucosa is dissected from the underlying muscular coat of the anterior vaginal wall (incorrectly termed pubocervical fascia). The bladder has been separated from its abnormal vaginal and uterine attachments.

tion of the vesicovaginal areolar connective tissue.

To the modified muscular coat of the vaginal wall in cystocele the term musculofascia has been incorrectly applied. The inaccuracy of such a term is apparent when one realizes the fact that this coat consists of approximately 80 per cent smooth muscle fibers. The irregularly arranged interfascicular connective tissue found in this layer does not constitute a fascia in any sense of that term. Bissell in 1929 deplored the application of the term fascia to the modified muscular coat of the vaginal wall in cases of cystocele.

The above description of the histologic changes in the vaginal wall in cystocele has been based upon the histologic examination of sections which include all tissue from the vaginal epithelium to the fibrous coat of the bladder. These sections have been made at various levels and locations in the vesicovagi-

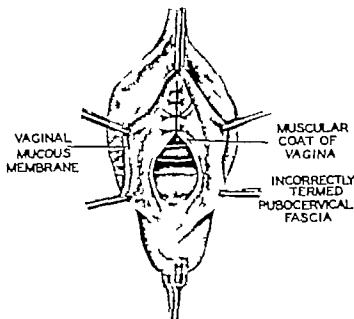


Fig. 15. Step 2: The muscular coat of the anterior vaginal wall (incorrectly termed pubocervical fascia) is sutured in the sagittal plane after the removal of the redundant part. The excessive part of the vaginal mucosa is removed and the cut edges are approximated in the sagittal plane of the body. (From E. Martin.)

nal septum in cases of cystocele of all degrees of size.

#### CLASSIFICATION OF OPERATIONS FOR CYSTOCELE AND URETHROCELE

The vaginal operative procedures for the correction of cystocele and urethrocele in which the principal feature has been the utilization of the so called pubocervical fascia are of four types (1) A type of operation in which the vaginal mucosa is denuded over a geometric design and the redundant part of the pubocervical fascia is infolded by sutures which also approximate the cut edges of the vaginal mucosa. Sims, Emmett and their contemporaries employed this type of operation. (2) A type of operation (Figs. 12 and 13) in which bilateral flaps of vaginal mucosa are dissected from the redundant pubocervical fascia which is then inverted by sutures. The excessive part of the mucosal flaps is removed and the cut edges are approximated in the sagittal plane of the body. (3) A type of operation (Figs. 14 and 15) in which the vaginal wall is opened in the sagittal plane from a point 1.5 centimeters posterior to the urinary meatus to a point at the level of the cervicovaginal junction by an incision which passes

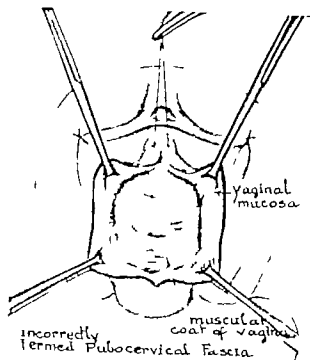


Fig. 2. Operation for cystocele (Type 1). Step 1. The vaginal mucosa is dissected from the underlying muscular coat of the anterior vaginal wall (Incorrectly termed pubocervical fascia).

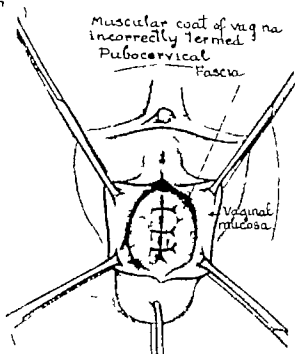


Fig. 3. Step 2. The redundant muscular coat of the vaginal wall is inverted by interrupted sutures. The excess part of the vaginal mucosa is removed and the cut edges are approximated in the sagittal plane of the body.

septum was corroborated by W. Blair Bell (Fig. 7) in 1910 by Goff (Fig. 8) in 1931 and by Koster in 1936.

#### THE NORMAL URETHROVAGINAL SEPTUM

The structure of the urethrovaginal septum (Fig. 9 and Fig. 10) differs from that of the vesicovaginal septum in one important respect. Between the muscular coat of the vaginal wall and that of the bladder wall there is a layer of areolar connective tissue which is absent in the urethrovaginal septum. In the urethrovaginal septum the muscular coat of the vaginal wall and the muscular coat of the urethral wall fuse so intimately that there is present no line of natural cleavage between them.

Along the line of this fusion there is a considerable amount of interfascicular connective tissue which tends to make the union an extremely firm one. There is no fascia between the wall of the urethra and the wall of the vagina. This fact alone makes the existence of the pubocervical fascia impossible.

#### THE HISTOLOGY OF THE VAGINAL WALL IN CYSTOCELE

The vaginal wall in which there is a cystocele or urethrocele has a characteristic structure (Fig. 11). Contrary to the general opinion, the vaginal wall is hypertrophied in all of its layers. This hypertrophy is proportional to the size of the cystocele. In the case of an extremely large cystocele of long standing the vaginal wall may range from 0.5 to 1 centimeter in thickness. As a rule the wall is not as thick in the sagittal plane as it is in the lateral part. In either part however there is a thickening of the epithelial layer, a moderate degree of hypertrophy of the tunica propria, and a remarkable hypertrophy of the muscular coat in which there is both a numerical and an individual hypertrophy of the irregularly arranged muscle fibers. In the muscular coat there is also a considerable amount of interfascicular connective tissue. There is a slight increase in the amount of connective tissue in the fibrous coat which is in reality a condensa-

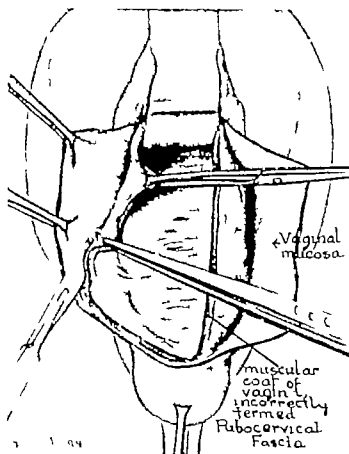


Fig. 14. Operation for cystocele (Type 3). Step 1: The vaginal mucosa is dissected from the underlying muscular coat of the anterior vaginal wall (incorrectly termed pubocervical fascia). The bladder has been separated from its abnormal vaginal and uterine attachments.

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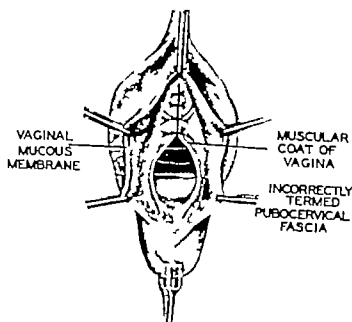


Fig. 15. Step 2: The muscular coat of the anterior vaginal wall (incorrectly termed pubocervical fascia) is sutured in the sagittal plane after the removal of the redundant part. The excessive part of the vaginal mucosa is removed and the cut edges are approximated in the sagittal plane of the body. (From E. Martin.)

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through the mucosa and the pubocervical fascia to the line of natural cleavage between the vaginal wall and the bladder wall. Along this line of cleavage the bladder wall is separated from its abnormal vaginal and uterine attachments. Following the mobilization of the bladder wall the mucosa is separated by sharp dissection from the pubocervical fascia which is then sutured in the sagittal plane as an individual layer. The mucosa after the removal of the redundant part is sutured in the sagittal plane as an individual layer over the reconstructed pubocervical fascia. And (4) a type of operation in which the vaginal wall is opened in the sagittal plane from a point 1.5 centimeters posterior to the urinary meatus to a point at the level of the cervicovaginal junction by an incision which passes through both mucosa and pubocervical fascia to the line of normal cleavage between the vaginal wall and the bladder wall. The bladder wall is then separated from its abnormal vaginal and uterine attachments. Following the mobilization of the bladder wall the redundant part of the vaginal mucosa and the pubocervical fascia is removed as a single layer and the cut edges are united in the midline as one layer.

In the above descriptions of operations the term pubocervical fascia is incorrectly applied to the muscular coat of the vaginal wall.

The anatomic and histologic facts herein enumerated are agreed upon by all authoritative anatomists and histologists. They constitute proof positive that there is no closely felted layer of fascia in or between the walls of the vagina, the urinary bladder or the urethra. They show that there is a delicate layer of areolar connective tissue between the vaginal wall and the bladder wall which because of its fragile structure is not involved in the etiology of cystocele. It is apparent there-

fore that cystocele and urethrocele are not caused by a defect in or an injury to a layer of fascia. It is equally apparent that those who believe that the pubocervical fascia is an anatomic entity must revise their concept of the etiology of cystocele and urethrocele if they are inclined to conform to firmly established histologic facts. The etiology of cystocele and urethrocele is a subject for future discussion.

#### CONCLUSIONS

- 1 There is no fascia in the walls of the vagina, the urinary bladder or the urethra.
- 2 There is no fascia between the vaginal wall and the urethral wall.
- 3 Between the wall of the vagina and the wall of the bladder there is a delicate layer of areolar connective tissue which because of its frail structure is not involved in the etiology of cystocele. There is no layer of closely felted fascia in the cervicovaginal septum.
- 4 The term pubocervical fascia has been incorrectly applied to the muscular coat of the vaginal wall.
- 5 There is no pubocervical fascia in the human pelvis.

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# STUDIES ON ECK FISTULAS IN DOGS

## A Simple Technique for the Preparation of a Portacaval Anastomosis with the Aid of a Clamp

SMITH FREEMAN Ph D., M D., Chicago Illinois

**P**ORTACAVAL anastomosis has been used as a means of studying the role of the portal circulation in the maintenance of liver function. The procedure is of current interest as a means of reducing portal hypertension in patients with cirrhosis of the liver. By the obstruction of the portal vein above this anastomosis it is possible to deprive the liver of approximately two-thirds of its blood supply. However the response of dogs which have had Eck fistulas made varies considerably; some animals can be maintained in good condition for several years (1) while others rapidly lose weight after the anastomosis is formed (2). It is apparent to one who has made this anastomosis by the cutting suture technique as described by Fishback that the size and patency of the stoma in different animals may vary considerably as a result of the anatomical variations in the relation of the portal vein to the inferior vena cava and of differences in the shape of the chest factors which influence the accessibility of these structures to the surgeon. Postmortem examinations at different intervals after Eck fistula formation reveal that in some animals the anastomosis remains patent while in others it tends to grow shut or to be greatly narrowed. These observations prompted a search for a more uniform and reproducible means of forming a communication between the two vessels in question. Theoretically it seems preferable to have a stoma of fixed and invariable size. To secure such a stoma, however would entail the use of a foreign object such as a vitallium cuff and its use would make the operation technically difficult in the dog. Since few foreign objects are well tolerated by the tissues over an extended period of time, it was decided to seek a method of

producing a more satisfactory stoma between two vessels without connecting them by means of a foreign object.

To assist in this purpose a clamp was necessary which would enable fixation and maintenance of the two vessels in definite relation to one another which would exclude blood from the operative field without completely obstructing either vessel, and which could be applied from the ventral surface of the vessels without extensive dissection or mobilization of them. The blood vessel clamps already described in the literature seemed unsuitable for this purpose. An attempt to use the Potts-Smith (4) clamp for this purpose was unsuccessful.

The clamp which was devised fulfills the three requirements mentioned. However practically complete occlusion of the portal vein may occur if the vessel is unusually small or if the relation between the two vessels is such that the anastomosis must be made distal to its usual location on the portal vein. Once the clamp is securely applied one can incise the vessels and form the anastomosis without hurry or blood loss. By means of this procedure portacaval anastomosis has been made in approximately 30 dogs. Some of these animals were used in the Eck or reverse Eck fistula experiments while in other instances the anastomosis was part of a one stage hepatectomy as described by Markowitz.

### PROCEDURE

Usually dogs weighing 30 pounds or more are used for this operation. With the anesthetized animal secured on his back the surgeon makes a midline abdominal or right rectus incision from the ensiform process to the penis of the male dog, or one slightly longer in the female animal. The intestines are retracted to the left side of the abdomen and

From the Department of Experimental Medicine, Northwestern University Medical School.

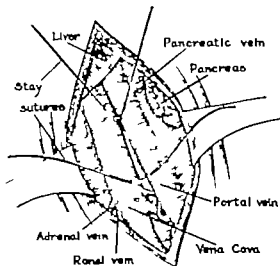


Fig. 1

Fig. 1 shows the technique of making a portacaval anastomosis with clamp.

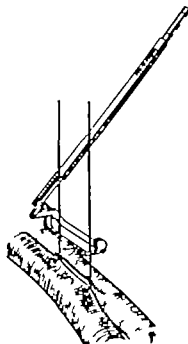


Fig. 2

are covered with a laparotomy pad. The hepatorenal ligament is cut and a laparotomy pad is placed over the surface of the liver and the left side of the incision.

The peritoneum, fat, lymphatic and fine blood vessels overlying the portal vein are completely cleared by blunt dissection from that portion of the portal vein which lies next to

the vena cava. The vena cava above the renal vein and below the liver is freed of fat and peritoneal attachments on the side next to the portal vein. After both vessel walls have been carefully exposed and cleared of overlying

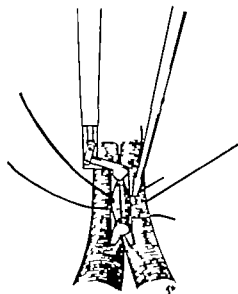


Fig. 3

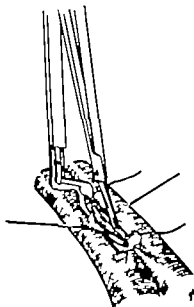


Fig. 4

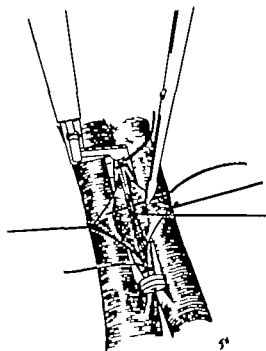


Fig 5

tissue stay sutures<sup>1</sup> are passed through opposite points of both vessels (Fig 1) at sites which will eventually be the two extremes of the anastomosis the suture closest to the liver just distal to the pancreatic vein is secured first. The distal suture is placed approximately one inch<sup>2</sup> from the first one at a point which is usually just rostral to the first visible branch of the portal vein—the stay sutures are approximately 8 inches long. Next the open clamp is held vertically with the handle side cephalward while the stay sutures are passed through its open jaws (Fig 2). Then as the clamp is applied to the vessels traction is made on the stay sutures. The surgeon manipulates the clamp and upper stay suture from the right side while an assistant retracts the abdominal wall and places traction on the lower stay suture. When the portion of each vessel between the jaws of the clamp is similar and adequate the clamp is closed until the vessels are held firmly. There should be  $\frac{1}{8}$  inch to  $\frac{1}{4}$  inch width of each vessel protruding between the jaws of the clamp for a distance of 1 inch. Once the vessels are secured the clamp is held in position by the assistant who exerts gentle traction as required for adequate ex-

<sup>1</sup>Carrel 20 mm. straight arterial needles and No. 5-0 or 6-0 black silk are used for the stay sutures and anastomosis.

<sup>2</sup>For dogs weighing 35 lbs. or more, larger sized clamp is used which permits the stay sutures to be placed  $\frac{1}{4}$  inches apart.

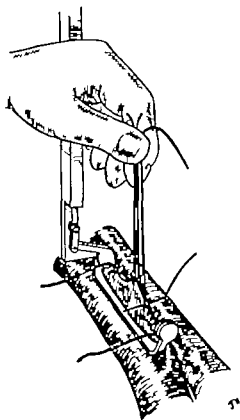


Fig 6

posure. Sutures for retraction of the lateral wall of each vessel are next secured to the mid portion of each vessel just lateral to its crest (Fig 3). By means of a fine sharp-pointed knife (e.g. cataract knife) or scissors each vessel is incised longitudinally just medial to its crest and near its lateral stay suture. The

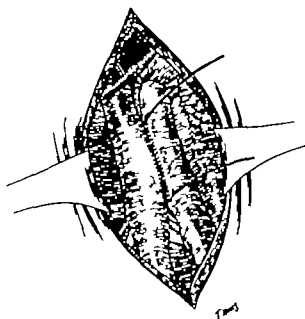


Fig 7 Eck fistula completed.





# TECHNIQUE OF LOW THIGH AMPUTATION

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THE care of patients with arteriosclerotic ischemic necrosis of the lower extremity still presents many unsolved problems. The correction of altered glucose fluid electrolyte and protein metabolism has promoted to a considerable degree the successful management of these patients. The intensive administration of antibiotic and chemotherapeutic drugs has for the most part eliminated pyogenic infections as a major cause of death. Revitalization of tissue completely necrotic remains impossible and allows recourse to no form of therapy save spontaneous or surgical amputation.

Although some difference of opinion still exists concerning minor details of thigh amputation, there has evolved during the past two decades a general agreement upon the principles of this operation. The combined contributions of McKittick, Samuels, Callender, Pearl, and others have simplified the technical aspects of low thigh amputation.

There has been a growing conviction that amputation of the lower extremity through the lower third of the thigh is more satisfactory than amputation at either a higher or lower site. It is true that there are definite indications such as occlusion of the common femoral artery or rapidly advancing anaerobic infection for performing amputations at a higher level. In the absence of such indications, however, no purpose is served by a high amputation. The difficulty in obtaining viable dermo-fascial flaps below the patella has for the most part led to abandoning transistibial amputations for arteriosclerosis obliterans.

The practice of subjecting a patient to a lumbar sympathectomy in order that amputation below the patella may be performed has not seemed justified unless there is reason to believe that the amputation can be successfully accomplished through the metatarsal area or distal to this site. There are very few

patients with ischemic necrosis of the toes or foot who are candidates for sympathetic interruption of vasomotor tonus. This does not apply to patients who have pain because of arteriosclerotic ischemia. Patients carefully and conservatively selected in this group may be afforded gratifying relief following lumbar sympathectomy. Atlas de Takats and Freeman have shown this to be true and our own experiences have confirmed their results.

During the past 2 years 35 amputations through the lower thigh have been performed for ischemic necrosis at University Hospitals of Cleveland. The neurovascular residents or the author have performed all the operations. The technique to be described has been used in all the procedures. The development of this technique arose from observing amputations performed by many different surgeons. The customary method of low thigh amputation consists of making anterior and posterior dermo-fascial flaps or a circular incision just above the condyles of the femur. The quadriceps tendon and the medial and lateral musculotendinous bands are cut. The sciatic nerve and popliteal vessels are dissected free and ligated. The femur is transected and closure performed. This technique usually demands alternate internal and external rotation of the thigh. During the course of fashioning the posterior flap and dissecting the popliteal vessels, the extremity is commonly held aloft by an assistant. It is not unusual to observe the surgeon in various awkward positions such as bending far over the operative field or assuming a squatting position while directing his attention to the posterior aspect of the thigh. The ease with which contamination of the sterile field can and does occur during this maneuvering on the part of the surgeon and his assistants is quite apparent.

It should be stated emphatically that operating speed is not to be commended when it is obtained by means of poor hemostasis, rough manipulation of tissues, and increased risk

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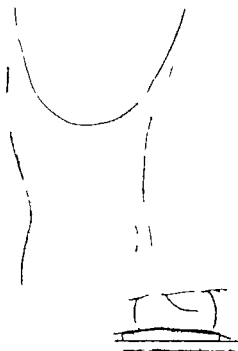


Fig. 1

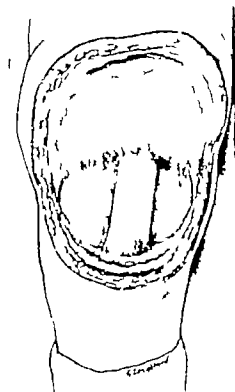


Fig. 2.

to the patient. The simplicity of the procedure to be described, however, allows the extremity to be maintained in one position during the entire operation. It allows no blunt dissection, minimizes blood loss and shock, and permits completion of the procedure within 10 to 20 minutes. The neurovascular residents who perform all amputations for vascular disease on staff patients adopt the technique with ease.

#### OPERATIVE PROCEDURE

Intravenous sodium pentothal, cyclopropane, spinal or refrigeration anesthesia are employed according to indication. Spinal anesthesia is preferred and used in the majority of patients. Refrigeration is used only when the patient is admitted with an acute progressing infection superimposed on arteriosclerotic ischemic necrosis.

The patient is placed flat on his back and the skin of the lower extremity is prepared from upper thigh to midcalf with 70 per cent alcohol and a one to five thousand solution of mercury bichloride. Figure 1 shows the position of the extremity from an anterior and lateral viewpoint. One moist sterile towel is wrapped around the midportion of the thigh and another about the leg just below the knee. Sterile sheets are placed beneath the extremity from the gluteal fold beyond the foot of the operating table. The leg and foot which have been held at an angle of 45 degrees from the table during the preparation are then enclosed in a sterile square table cover and wrapped loosely with sterile gauze. A double sterile sheet is then placed over the upper thighs and lower abdomen so that the lower border approximates the lower border of the sterile towel wrapped about the thigh. The sheet

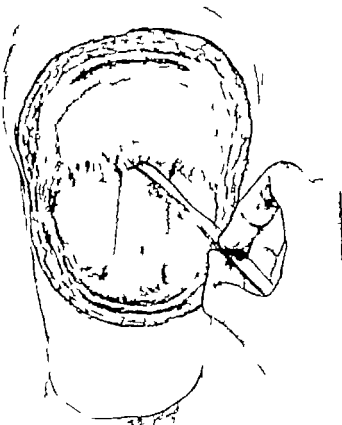


Fig 3

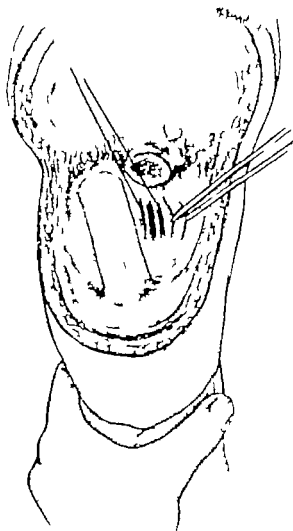


Fig 4.

is clipped to the towel. The entire field is then covered with a lap sheet after the extremity is inserted through the central opening. This is done in order that the extremity may be removed from the operative field as soon as the amputation has been effected. A sterile block of wood (Figures 1 and 2) 8 by 6 by 1 inches is placed beneath the popliteal space. A tourniquet is never used except in the rare instance that refrigeration anesthesia is employed. The extremity is flat on the table and is never moved during the operation.

A horseshoe shaped incision is made on the anterior surface of the thigh (Fig 1). The base of the incision lies at the upper border of the patella. The incision includes skin, subcutaneous tissue and fascia. The great saphenous vein is identified, clamped and ligated with No. 0 chromic catgut. The quadriceps

tendon is incised and the entire dermofascial flap is elevated in this manner exposing the anterior aspect of the femur (Fig 2).

A periosteal elevator (Figure 3) is used to remove the periosteum from the anterior and lateral aspects of the femur for a short distance about 5 centimeters above the condyles. A small curved hemostat is inserted behind the femur where the periosteum has been removed. A Gigli saw is drawn through. The saw is represented on Figure 3 by the dotted line at the proximal end of the exposed femur. The femur is then transected by using the saw in a lateral to-and-fro motion. Too much vertical tension will cause the saw to break. The wound is washed with saline during transection of the femur. A hand saw is not used because of the danger of injuring the popliteal vessels.

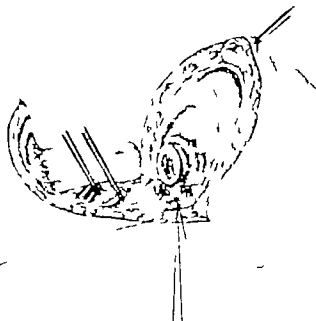


Fig. 5



Fig. 6

The distal end of the femur is angulated medially (Fig. 4). The popliteal vessels are easily visualized, dissected free, clamped, cut

and ligated doubly with No. 0 chromic catgut. The sciatic nerve is also readily identified. If its accompanying small artery is readily visualized

lized it is ligated separately. Gentle traction on the nerve is made and it is sharply cut with a knife. It then retracts. Neither alcohol nor procaine is injected into the stump of the nerve.

Figure 5 shows a lateral view after the popliteal vessels and the sciatic nerve have been cut. The dotted line in this figure indicates the line of incision for the posterior dermo-fascial flap. An amputation knife is employed for this incision which starts within the wound at end of femur and continues obliquely outward and downward through the musculotendinous bands of the semimembranosus, semitendinosus and biceps femoris. The posterior fascia is incised and the incision terminates through the skin at the lower border of the popliteal fossa. The amputated leg is removed from the operative field.

The square corners of the posterior dermo-fascial flap are then excised (Figure 6). Four or five interrupted sutures of No. 0 chromic catgut are used to approximate the anterior and posterior layers of fascia over the stump of the femur. Interrupted silk sutures approximate the skin in eversion. No drains are used. Dry sterile dressings and a neurological roll are applied. Figure 7 shows a stump on the eighth postoperative day.

#### DISCUSSION

This operation has been performed 35 times during the past 2 years with one postoperative death from uremia on the tenth day following operation. Necrosis of the skin flaps occurred in 1 patient who developed a retrograde thrombosis of the superficial femoral artery extending into the common femoral artery. All of the patients had arteriosclerotic ischemic necrosis and all had superimposed pyogenic infections. All of the operations were performed by the neurovascular residents or the author. Although it is felt that the technical aspects of the procedure contributed beneficially to the welfare of these patients, considerable attention was devoted to the preoperative cor-



Fig. 7

rection of anemia, dehydration, cardiac decompensation, acidosis and other complications commonly seen. Penicillin was administered routinely. Postoperative activity was encouraged. The wounds were first dressed on the fifth postoperative day.

Although the technical aspects of this method of thigh amputation were not found in the literature, a complete survey was not possible because of the inaccessibility of some foreign journals.

#### SUMMARY

A technique of low thigh amputation is presented. The principal advantages are the facility with which the operation is performed, the elimination of awkward maneuvering by the surgeon, the reduction of potential sources of contamination, the minimal amount of blood loss and tissue trauma and the ease with which patients stand the procedure.

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## BLOOD BANK ORGANIZATION

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**D**URING the ten year period before the last war physicians began to use progressively increasing amounts of whole blood and plasma in the treatment of patients. This increase was a direct result of better and more popular acquaintance with the value of blood as a therapeutic agent as proved by exhaustive experimental and clinical investigation. The demand soon was so great within hospitals that it became desirable to store these substances in advance of need in order to avoid dangerous and wasteful delays in emergencies and to insure satisfactory and prompt transfusion therapy. A need for improvement in the many technical aspects pertaining to the drawing, storage, preparation and administration of these substances naturally followed and these were brought to a satisfactory stage of development through the work of a host of independent investigators.

Throughout the period of the war physicians in both military and civilian practice further observed the value of blood and plasma and popularized its use in shock and hemorrhage in sepsis and anemia, and in parenteral alimentation for many other diseases. Meanwhile the production, supply and administration of blood and plasma and its derivatives for patients in the armed services through the co-ordinated efforts of individual investigators, military physicians, universities, the National Research Council, The American National Red Cross, and commercial drug firms, developed with amazing rapidity to the point of satisfactory operation.

In civilian practice comparable strides in the provision of blood and plasma have not been made either during the war years or in the postwar period. Limitations imposed by the war, chiefly the demands on medical personnel and the necessary restrictions on ma-

terial were such that little progress was possible throughout its duration. It is now 3 years after the end of the war and the restrictions no longer exist yet the problem of blood bank organization adequate to meet the needs of every community is unsolved. In order to contribute to its solution let us first state clearly the needs, and then examine critically possible methods for their satisfaction. Every hospital in America should have immediately available properly prepared whole blood and plasma in suitable form and in amounts sufficient to meet the needs of practice within that hospital. This is the ideal but for purposes of practicability minor compromises can and should be made under any organizational plan. Adequate medical care however cannot be compromised and it must include blood and plasma service that meets the requirements of the patient, the physician and the hospital.

The first and most obvious solution to the problem is that of the individual hospital supplying its own blood and plasma. This is done in many hospitals but there are natural obstacles which stand in the way of a completely adequate service. The chief of these is the difficulty of maintaining without waste a sufficient inventory of blood of the various groups and of plasma reserves to satisfy all requests. This is even more true since attention must now be paid to the Rh factor. For example only about 1 donor in 350 has blood of group AB Rh negative, 1 in 60 of group B Rh negative and 1 in 16 of group A Rh negative or O Rh negative. Substitutions may be made in some instances but they are also limited. Other obstacles to a complete service within a single hospital include the depletion of whole blood inventory to provide plasma reserves, the cost of equipment, trained personnel and proper supervision and space requirements.

In discussing conditions within the individual hospital it is not meant to imply that hospitals in general cannot manage most of their own blood transfusion obligations sim-

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ply, effectively and economically. Those hospitals large enough to maintain a pathologist, a clinical pathologic laboratory, and a resident house staff are equipped with the necessary personnel. In almost all hospitals the clinical pathologist is a physician of high intellect well versed in the theoretical and practical phases of safe blood transfusion. Improved apparatus which facilitate the transfusion of blood properly preserved in closed pyrogen free containers are available at low cost from commercial houses as are grouping and anti Rh testing serums of excellent titer and specificity. In most instances in which blood transfusion is desired the proper donor may be found among friends of the patient without undue delay and reserves of blood are not needed. In the larger hospitals (those of 300 or more beds) small blood bank organizations can properly be operated further to fulfill blood transfusion obligations. These functions are ably performed by the hospitals and their staffs and they should continue to maintain self reliance by participating to the limit of their respective abilities.

Since the ability to meet the circumstances naturally varies greatly with individual hospitals, it follows logically that blood bank organization within a community should be devised to supplement the hospital service in accord with the particular needs. For example, one hospital may care to use the central organization only when friends of the patients cannot be located or when available donors or reserves of blood are not of the compatible blood group or when an emergency exists which does not permit waiting for laboratory search. A smaller hospital lacking personnel may find it more suitable to rely upon the organization as a source for all blood used. In the relatively few instances in which plasma is more desirable than whole blood, all hospitals except those large ones properly equipped to prepare their own plasma would rely upon the central organization.

The problem as it exists within the individual hospitals has been reviewed in order to fix the amount of help required to make complete a blood transfusion service for any given community. This step is necessary if the problem is to be approached intelligently and conflict

with existing functions within the hospital avoided. Nine years ago in the greater Cincinnati area a community blood and plasma transfusion center was organized according to this concept. It has met with considerable success. At this point it seems desirable to trace its growth, describe how it operates, and refer to some of its accomplishments.

The project was designed in the Department of Surgery at the University of Cincinnati and the Cincinnati General Hospital and has been in operation since December 10, 1938. Its pioneer development was sponsored by the Cincinnati and Hamilton County Chapter of the American Red Cross, though it was without precedent for a local chapter of the American Red Cross to collaborate with a university in order to produce such an organization. In the first few years of operation the blood bank was used largely for the benefit of patients in the Cincinnati General Hospital, all of whom are on a free medical service basis. A nominal charge was made to the occasional private hospital patient requiring bank blood. As this phase of the service expanded, the Red Cross felt that it was being put in the position of selling blood, which was in conflict with its policy. At the same time the service had become self supporting and transfer of sponsorship could be made without requiring a subsidy. On January 1, 1944, at the request of the Red Cross, sponsorship was transferred to the University of Cincinnati and the project is now known as the University Blood Transfusion Service. It operates for the Cincinnati General Hospital and for 15 hospitals in the metropolitan area.

The office and laboratory facilities and details of the methods, technique, and equipment used in the drawing of blood and in the preparation and processing of plasma have been described elsewhere (1, 2, 3, 4, 5, 6). The service is directed by a member of the attending staff of the Department of Surgery. A secretary, 6 laboratory technicians, a graduate nurse, and a diener are employed and a number of part time volunteers, some of whom are Red Cross nurses aides, serve at regularly scheduled hours.

The service provides whole blood, plasma in the liquid, frozen, and dry states, and red



blood cells in dextrose solution. Plasma production has been suspended since the Army and Navy surplus was made available but will be resumed when this supply is exhausted. Ordinarily all hospitals participating in the service are given a supply of plasma for use in emergencies. Whole blood is dispensed only at the request of a physician for a specified patient. Whenever a unit of whole blood or plasma is issued the information needed by the service is entered on a printed form which records the amount of whole blood or plasma desired, the name of the patient, the method of repayment if it has been decided upon, the signature of the physician and the signature and address of the responsible relative or friend. Neither the physician nor the hospital assumes any responsibility for seeing that repayment is made. The physician is asked merely to explain the obligation to the patient or his relative at the time the slip is signed and the hospital simply to see that the service receives the forms properly filled out.

Much of the success of this project is due to the fact that repayment of the obligation to the service is made according to the circumstances of the patient and his family. These circumstances are indicated on the request forms by the physician. Most patients fall in to one of four classifications. If the patient is financially able and has willing blood donors the charge is \$12.50 and one donor for each unit of blood (500 c.c.) or plasma (250 c.c.) if he is financially able and has no willing donors the charge is \$25.00. If he has willing donors but is poor, two suitable donors are accepted for each unit used. If the patient is indigent and has no friends willing and able to serve as donors, the blood or plasma is supplied without obligation out of reserves obtained from those repaying with two donors. Red blood cell suspensions are a by-product of plasma preparation and are charged for at one-half these rates. All classifications are flexible and obligations are always adjusted to meet the circumstances. For example, if the patient who is neither indigent nor well-to-do has received many units of blood or plasma and has been subjected to the expense of protracted hospital and medical care, any part of the accrued obligation either in blood donors or in

money is acceptable as payment in full. A statement by the patient's doctor as to the limit of the ability to pay is accepted as final. In any event no method of collection other than a simple statement of obligation is ever used. At no time during the 9 years of operation of this service has a request for blood or plasma been refused, the reserves have never been exhausted and no blood has been purchased from donors by the service.

Donors present themselves at central headquarters during 3 regularly scheduled half-day periods each week. At these times a physician is present to draw the blood. He is paid by the participating hospitals, the share of each being prorated according to the number of transactions during the preceding month. In 1946 this amounted to about 20 cents for each transaction. There is no other charge made to hospitals by the service.

In a few respects the operation of the service for patients in the Cincinnati General Hospital differs from that for patients in other hospitals. Since patients in the General Hospital are on a free medical service basis, all repayment is made with blood donors on a unit for unit basis and no cash payments are ever received from patients. In return the General Hospital provides the service with space, heat, light, laundry and some chemicals.

The usefulness of this service to the community is indicated by its growth expressed in terms of the number of transactions in units of whole blood and plasma. During the years of operation there has been a progressive increase from 2,687 units for the year 1939 to 8,025 units for the year 1945. This dropped to 7,152 units in the year 1946 because of the use of free government plasma to supply part of the demand. From 1943 to 1946 inclusive, 15,148 units of whole blood and plasma were issued to the General Hospital and 13,136 units were issued to other participating hospitals making a total of 28,284 units of whole blood and plasma for the 4 year period.

The financial operation of the service has been satisfactory. Expenditures consist of salaries for secretarial and technical personnel, supplies for the office and laboratory including grouping serum and all items used in donor sets, and maintenance in the general

headquarters and on refrigeration and laboratory equipment. There is no salaried medical direction. The income to the service is derived entirely from patients who are paying for private hospital and medical care and who have received blood or plasma from the service. The total expenditure for the 4 year period from 1943 to 1946 inclusive was \$54 107 18. The total income during this same period was \$87 060 59 leaving a surplus of \$32 953 41 despite the fact that more than half the transactions involved patients making repayment with donors only. This surplus is to be used in the purchase of new equipment for the blood transfusion service when the building program permits new headquarters. Since in the 4 year period from 1943 to 1946 inclusive there were 28 284 transactions in whole blood and plasma and \$87 060 59 in income each transaction cost the service about \$3 00. This cost was paid by the patients who received the benefits at the rate of not more than \$25 00 or \$12 50 and one donor for each unit. In no instance has attempt at collection been more than a simple statement of obligation to the patient and blood and plasma in any amount requested have always been issued regardless of the financial circumstances of the patient.

A description of this service has been made in order to illustrate how the blood transfusion problem has been managed in a single community. It has been moderately successful in its accomplishments but they fall short of being ideal. A careful check reveals that only about 95 per cent of the requests are satisfied promptly. In the remaining 5 per cent there is delay in supplying Rh negative blood of a specified group or blood of group AB and B. A second defect in the service is that no provision is made to serve hospitals in outlying smaller cities and towns. It would not be difficult to extend the service to include these localities by altering the organizational plan. Such an extension would at the same time mitigate the problem of shortages of the rarer groups of blood because of increased inventories that would result.

The service which has just been described obviously will not suit exactly all communities but if it were applied to others throughout the country the plan could and should be

made as flexible as necessary to meet the requirements of each. The variables to be met would be the number and sizes of the participating hospitals and the distances between them. For example by the adoption of standard apparatus and techniques for the drawing of blood hospitals at greater distances might make periodic collections of blood from friends and relatives of patients and transport them to the center in return for a supply of plasma and blood of more useful distribution in relation to the blood groups. Hospitals close to the center might prefer to have the blood collected there and to draw out both whole blood and plasma according to need. The size of the hospital and the degree to which it has developed its own transfusion service would also determine the extent of its reliance upon the center. Schemes of operation would have to vary in order to suit both community and hospital requirements but they would resemble one another in their fundamental objectives. This phase of the problem that of working out details of the plan in a particular community should not prove to be difficult.

In order to develop and put into effect similar blood bank organizations operating from within strategically located cities and have them serve the entire country the impetus must come from an organization capable of dealing with the problems on a nationwide scale. Authority should then be delegated to agents within state or other regional units to co-ordinate the activities in each. The interests of the community would best be served if these agents were physicians associated with medical centers who would then be in a position to understand the problems within the hospitals as well as within the community. These men should be carefully selected for their interest in and knowledge of the theoretical and practical aspects of blood transfusion and for their administrative ability.

#### SUMMARY

The plan of blood bank organization now in operation in the Cincinnati area has worked effectively and economically for almost 9 years. It could be adopted on a nationwide basis adjusted to suit every community and yet retain its fundamental principles not the

least of which is the preservation of individual responsibility. The patient would receive blood and plasma in the amount needed regardless of his financial circumstances. If payment in money could not be made he still would be allowed to participate by supplying blood donors from his friends and relatives. If he had no willing donors he would not be denied the service. There would be no restrictions placed on the physician either by the amounts of blood or plasma readily available or by the financial ability of his patient.

In the majority of blood transfusion procedures there is enough time and sufficient personnel and facilities within the hospital to secure suitable donors among friends of the patient and to draw and administer the blood. Under a community plan as described the hospital would continue to be self-reliant to the limits of its ability but deficiencies in its service would be complemented.

The service would be paid for by those who receive the benefits without excessive cost to the individual and without the need for a protracted annual subsidy from any source. Because the service would be self-supporting it could not become a financial burden to the community.

A plan to provide blood without charge to all and to finance the project by the use of a subsidy however derived, would be ill advised. This is the most extravagant method of establishing an essential service. There is no such thing as blood without costs. Any transfusion service, whether locally or nationally organized, requires the employment of skilled personnel trained for highly technical jobs. Their services will cost money. These costs, if

not paid by the person who receives blood, must be paid by others. Thus to speak of transfusion service without charge is merely to indulge in double-talk. Such a scheme would discourage the fulfillment of personal obligations and invite charity where it is not needed. It would also by creating among the masses an appetite for gifts and the habit of receiving them build up a mountainous service much of which is not needed because it is already being supplied effectively within individual hospitals. Any organizational plan devised to supplant existing hospital services would become vastly more expensive than one which afforded only the help necessary to make them complete.

Adequate blood transfusion service for every patient is important enough to justify the use of a subsidy if it cannot be avoided. One way of solving the transfusion problem in communities might be the sponsorship of a national program by a scientific organization willing to make an initial subsidy and then turn over control as the local organizations become self-supporting. It is essential to consider methods which preserve the fundamental principles of self-reliance and individual responsibility.

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# EDITORIALS

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### VAGOTOMY AND THE MANN- WILLIAMSON ULCER

THE discovery by Mann and Williamson<sup>1</sup> of a method which regularly leads to the production of progressive peptic ulcers in experimental animals has proved to be of great importance in the study of the pathogenesis of these lesions. It has also made possible an evaluation of various therapeutic procedures both as prophylactic and as curative measures under the controlled conditions of the laboratory. It seems probable that the explanation proposed for the cause of these ulcers is correct namely that they are due to the corrosive effect of the acid gastric content on the jejunal mucosa when deprived of the continuous neutralizing effect of the alkaline duodenal secretions. In this connection however, certain observations made by the present writer are of interest and not easily explained.

Thus when the pancreatic juice in dogs is diverted to the exterior by a fistula of the

type which has been described by Dragstedt, Montgomery and Ellis<sup>2</sup>, progressive ulcers appear in the duodenum in almost every case and are exceedingly difficult to prevent. Total pancreatectomy however which also excludes pancreatic juice from the duodenum, is almost never followed by ulceration. In over 500 of these operations in our laboratory, the incidence of ulcer is less than five per cent. We have not been able to demonstrate that pancreatectomy decreases gastric secretion, so the failure of these animals to develop ulcers remains unexplained.

Although the effect of complete vagotomy on the development of experimental Mann-Williamson ulcers was not investigated before this operation was introduced<sup>3</sup> for the treatment of intractable peptic ulcer in man, it has subsequently been studied in our laboratory and simultaneously by several other investigators.<sup>4,5,6,7</sup> It seems clear that vagotomy has little or no beneficial effect on the occurrence or course of these ulcers. This is in striking contrast to the effect of complete vagotomy in gastrojejunal ulcer in man. Here the ulcers heal<sup>8</sup> and have remained healed for periods of three to five years. The opinion of almost all surgeons is apparently unanimous that vagotomy is a satisfactory treatment for gastrojejunal ulcer following the performance of either gastroenterostomy or gastric resection in man.

<sup>1</sup>Dragstedt, L. R., Montgomery, M. L., and Ellis, J. C. *Proc. Soc. Exp. Biol.* 1930, 38, 100.

<sup>2</sup>Dragstedt, L. R., and Owens, F. M. Jr. *Proc. Soc. Exp. Biol.* N. Y., 1943, 31, 132.

<sup>3</sup>Enerson, D. M., Woodward, E. R., Torrey, E. B., Neal, W. B., Shiley, J. A., and Dragstedt, L. R. *Arch. Surg.* (in press).

<sup>4</sup>Hartley, H. N., and Hooker, D. H. *Surgery* 1947, 2, 244.

<sup>5</sup>Saltstein, H. C., Sandwisch, D. J., Hammer, J. M., Hill, E. J., and Vandenberg, H. J. *Arch. Surg.* 1947, 55, 130.

<sup>6</sup>Wolver, J. V. *Arch. Surg.* 1947, 55, 180.

<sup>7</sup>Dragstedt, L. R., Clarke, J. S., Harper, P. A. Jr., Woodward, E. R., and Torrey, E. B. *J. Thorac. Surg.* 1947, 14, 126.

<sup>8</sup>Mann, J. C., and Williamson, C. S. *Ann. Surg.*, 19, 3, 77, 400.

What is the explanation for this marked difference in response to vagotomy displayed by the experimental as compared with the clinical ulcer? Is the Mann-Williamson ulcer in dogs strictly comparable to the stoma ulcer seen in man? These are important practical as well as theoretical questions.

One obvious difference between the two lesions depends upon the fact that in the experimental ulcer the duodenal secretions are deviated completely into the lower intestine while in most stoma ulcers in man these secretions pass over the ulcer area. An exception to this latter statement is the stoma ulcer that develops when a Roux or Y type of gastroenterostomy is performed. Exalto<sup>3</sup> many years ago called attention to the high incidence of stoma ulcers with this type of anastomosis, both when done for duodenal ulcer in man or when constructed in normal dogs. It is quite likely that the pathogenesis of these experimental ulcers of Exalto is similar to that of the Mann-Williamson lesion. The Y type of gastroenterostomy has now been abandoned for the treatment of duodenal ulcer but occasionally stoma ulcers are encountered in man when the situation resembles that in the experimental ulcers of Exalto and of Mann and Williamson.

Two cases of this type have been recently encountered in our clinic and are of interest in that a complete vagotomy failed to prevent their occurrence or permit them to heal. In both cases, vagotomy plus gastroenterostomy was performed for intractable duodenal ulcer with pyloric stenosis. Because of subsequent obstruction to the proximal loop at the site of anastomosis, an entero-entero anastomosis was made between the proximal and distal loops of jejunum. This had the effect of diverting the duodenal juices from the region of the anastomosis and creat-

ing a situation resembling that in the Mann-Williamson ulcer. Progressive stoma ulcers appeared in the jejunum adjacent to the anastomosis in spite of the fact that physiological studies indicated that the vagotomy had been complete. Since these are the only stoma ulcers encountered in a series of 168 complete vagotomies with gastroenterostomy the adverse effect of sidetracking the duodenal secretions from the region of the anastomosis becomes more impressive. It is likewise important to emphasize that we now have evidence both from the laboratory and the clinic that vagotomy will not prevent or cure stoma ulcers that arise under the conditions which have been mentioned.

Considerations such as these make one question the advisability of using the Mann-Williamson preparation as a test object for the efficacy of therapeutic measures proposed for peptic ulcers in man. It is probable on the basis of recent findings that most duodenal and stoma ulcers are due to gastric hypersecretion and that complete absence of the automatic neutralizing effect of the duodenal secretions plays the predominant role in only a few special situations such as those here discussed. Gastroenterostomy is not followed by stoma ulcer unless gastric hypersecretion exists or is experimentally produced or unless the duodenal secretions are diverted from the area of anastomosis. It is for this reason that jejunal ulcers do not occur after gastroenterostomy in normal dogs or in man with carcinoma of the stomach or gastric ulcer associated with normal or depressed secretion. When the excessive gastric secretion characteristic of patients who have duodenal ulcer is returned to normal values by complete vagotomy stoma ulcers do not take place unless the duodenal secretions are diverted from the region of the anastomosis.

<sup>3</sup>Exalto, J. *Mitt. Grenzgeb. Med. Chir.* 612, 23, 3.

## THE PRESENT STATUS OF PULMONARY RESECTION IN THE TREATMENT OF PULMONARY TUBERCULOSIS

SINCE Brauer and Frederick reported the performance of a successful thoracoplasty more than forty years ago, thoracic surgeons throughout the world have been increasingly interested in the surgical treatment of pulmonary tuberculosis. Many new collapse procedures, some good and some bad have been devised and all the acceptable ones have been tested for their therapeutic value. The indications for each have been crystallized and clarified so that we know with reasonable assurance what to expect. While several procedures have been effective there still remains a limited group of patients who are in need of more adequate measures to eliminate tubercle bacilli from the sputum. Under such circumstances it is not strange that pulmonary resection should finally come under careful consideration. During the past ten years resection has been given a trial in an increasing number of patients. The results have been rather unsatisfactory. The technique used in earlier resections necessitated cutting through tuberculous tissue in dividing the hilar structures a step which resulted in many serious complications and often in death. Later with refinements in technique, which included the individual ligation of the hilar vessels, and with a more careful and painstaking handling of the bronchus, results have been improved.

In 1942 46 cases of lobectomy were reported with a mortality of 25 per cent, and 29 cases of pneumonectomy with a mortality of 45 per cent. The satisfactory results were tabulated as 68 per cent for lobectomy and 41 per cent for pneumonectomy. These cases were particularly interesting because in many of them a

diagnosis of tumor or of some other nontuberculous lesion had been made however, following operation the condition was found to be tuberculosis. The indications for operation were varied, among them were tuberculoma, tuberculous bronchiectasis, bronchial stenosis and postthoracoplasty cavity. Complications were common and included fistula, contralateral spread, empyema etc. The best results were reported in that group of patients whose sputum was found to be negative for tubercle bacilli previous to resection.

One might expect the poor results obtained in the early group of cases to act as a deterrent to any enthusiasm which might arise in favor of the procedure. This is not true however, for since 1944 an increasing number of patients have had pulmonary resection performed to relieve a variety of conditions. A sufficient length of time has not yet elapsed to determine what the final results will be. Up to the present the indications for resection have been flexible and have varied widely throughout the country. Certain facts must be kept in mind if pulmonary resection is to rest in the niche occupied by approved methods of treatment. Tuberculosis is not localized in one structure of the body distant foci may lie dormant for long periods, a fact which may permit a false sense of security both to the physician and his patient. Later, through deleterious influences and alterations in physiology, these foci may become active and the disease become more formidable than before. Such relapses are typical of tuberculosis and may have no connection with any form of previous therapy. It is important that each patient who is considered for surgical treatment should be carefully studied and that all the possibilities be weighed by a team consisting of at least an internist and a surgeon with sufficient experience and knowledge of the vagaries of the disease to permit a logical choice of procedure.

Pulmonary resection whether lobectomy or pneumonectomy is a major operation regardless of the pathology present. The loss of respiratory function must be seriously considered both as to its immediate and late effects. The useless sacrifice of normal functioning pulmonary tissue may be ill advised. This statement is borne out by the latest reported results in approximately 400 cases of resection in less than 50 per cent the sputum was negative on culture, in over 30 per cent it was positive and 25 per cent of the patients are dead.

While the indications for resection still vary probably the most outstanding and universally acceptable are (1) Failure of the thoracoplasty. Failure necessarily implies an adequate thoracoplasty which has failed to close a cavity with a resulting bronchiectasis and with the sputum positive for tubercle bacilli. Resection is indicated in such cases when the opposite lung or remaining lobes are free from disease or show only quiescent minimal lesions. (2) Bronchial stenosis which represents a burned out lesion with cicatricial contracture of such a high degree that it interferes with drainage and leads to frequent bouts of recurrent pneumonia, atelectasis, lung abscess, and toxemia. The stenosis may be in a stem or lobar bronchus. (3) Tuberculoma, not infrequently located near the hilum and causing bronchial obstruction cannot always be differentiated from carcinoma. Delay in such cases may in certain instances, invite disaster. (4) Failure of a pneumothorax. Adequate collapse is obtained which is equal to or superior to what might be expected from thoracoplasty but the underlying cavities remain open and the sputum positive. Other indications less clear include (5) Giant cavities. Some prefer in such cases a trial of collapse therapy before extirpation while others carry out resection on the premise that collapse measures will be unsatisfactory. Collapse therapy is to

be preferred if a reasonable chance of success seems likely. (6) Basal lesions which should be treated by means of some type of collapse therapy in the form of artificial pneumothorax, phrenicotomy or pneumoperitoneum, and should be given preference of trial. (7) Hilum lower lobe apical and middle lobe cavities are not readily amenable to thoracoplasty but other minor collapse procedures merit careful consideration.

The most common and serious complications and sequelae after resection are (1) Re-activation or spread of the tuberculous process in the remaining pulmonary tissue, ipsilateral or contralateral. The complete elimination of spread or reactivation is impossible but a more careful and thorough study of the tuberculous process will certainly reduce the frequency of its occurrence. Following lobectomy the forced overexpansion of the remaining lobe or lobes which undoubtedly contain unrecognized healed and unhealed lesions, is dangerous. Thoracoplasty performed either at the time of or at an early date following resection will accomplish three important things. It will obliterate the pleural space left after the resection. It will prevent the overdistention of the remaining lobe, and it will at the same time permit normal function of the lobe. (2) Mixed infection or tuberculous empyema. Early obliteration of the dead space by thoracoplasty and phrenicotomy following pneumonectomy reduces the duration of disturbed respiratory function, lessens mediastinal shift with overexpansion of the remaining lung and reduces the chances of infection, early and late. We have no assurance that a longstanding dead space following pneumonectomy for tuberculosis will react any differently than that in those cases of extrapleural pneumothorax or oleothorax in which a tuberculous extrapleural empyema has occurred in 50 per cent of the cases as long as five years

later (3) Bronchial fistula. When a bronchial fistula connects with a large dead space, early infection follows. Such fistulas are most common in cases in which acute tuberculous bronchitis exists at the time of surgery. Until the disease in the bronchus is brought under control, operation should be delayed and other procedures should be used to treat the acute process. This precaution will also reduce the ulceration which is encountered in the bronchial stump and which has been found to contribute to the persistence of tubercle bacilli in the sputum.

Streptomycin has proved to be valuable in the treatment of tuberculosis and should be tried before surgery is instituted particularly if a tuberculous bronchiectasis existed before or continues after thoracoplasty. The drug has given excellent results in acute tubercu-

lous bronchitis. It has also been valuable in controlling and perhaps preventing, acute tuberculous empyema following resection. Streptomycin can be introduced directly into the pleural cavity previous to obliteration by thoracoplasty. Streptomycin gives promise of controlling for a time at least, early post operative spreads.

Resection in pulmonary tuberculosis is not the final answer. It is a dangerous operation and decision to use it must be made only after other recognized collapse procedures have been carefully considered and found wanting. To ignore this warning will bring disrepute to a therapeutic measure which has its place in the treatment of pulmonary tuberculosis. The value of resection can be determined only by the results obtained over a long period of time.

JOSEPH W. GALE.



# THE SURGEON'S LIBRARY

## REVIEWS OF NEW BOOKS

THE second edition and revision of *Normal Encephalogram* by Davidoff and Dyke was undertaken alone by Dr. L. M. Davidoff due to the tragic and untimely death of Cornelius C. Dyke on April 23, 1943. This very worthwhile book first appeared in 1937 and was written in response to numerous requests from neurological surgeons, neurologists, roentgenologists, pediatricians, and internists. In the fields of all these specialists, encephalography is utilized and basic knowledge of the appearance of the normal encephalogram is essential in order to make correct interpretations of the roentgenograms after the injection of gas.

The object of the book is to present a fundamental thesis on encephalography based not only on the author's experience with many thousands of encephalograms but also a review of the literature on this subject. As stated in the preface to the first edition, "The body of the book is concerned with what might be termed encephalographic anatomy. By this we mean the anatomy of the living brain and its coverings viewed by means of the contrasting shadows of tissues and gas in the stereoscopic roentgenogram."

The various chapter headings and contents in the second edition are essentially unchanged from the first edition. There are, however, numerous additions and there is a very worthwhile review of all new contributions on encephalography appearing in the recent literature.

Anyone interested in any phase of encephalography will find this volume most valuable.

HOWARD N. LAWDER.

WHEN one contemplates the treatment of a patient who has a surgical disease it is amazing to find how much more is necessary to treat the patient properly than simply knowing the anatomic diagnosis and having the ability to perform a standard operative procedure. Allusion may be made to just a few items such as hydration, the nutritional status including vitamin balance, blood picture, electrolytes, blood chloride and protein levels, and nitrogen retention. Moreover complicating anatomic disorders must be detected, controlled, or corrected if possible before surgery is attempted. Among these may be mentioned oral sepsis, diabetes, chronic nephritis, coronary disease, prostatic hypertrophy and abnormal mental states.

It is desirable to alter at least to a degree, the methods of teaching of surgery. Too often pro-

cedures and precepts are presented and advocated without giving the reason or philosophy for such. The proper management of a disease in its various stages and in different types of individuals that may have anatomic complications or abnormal physiologic states can be carried out only by one possessing much basic information and the ability to utilize such information to build a correct therapeutic structure. Trusting to memory alone is not sufficient because any surgeon will soon encounter a condition that he has not been specifically instructed about; moreover without reasoning experience less likely will develop his mental stature. Therefore correct teaching necessitates supplying a foundation on which by guidance in thinking and reasoning an accurate mental structure can be erected.

With these points in mind the recent work by Bancroft and Wade has been surveyed rather critically and it is gratifying to state that in general these requirements have been fulfilled. This work *Surgical Treatment of the Abdomen* first appeared in 1941 under the title of *Operative Surgery* and was to be one of several volumes to be published by another publishing house. The plan did not materialize and in time the present publishers arranged for the complete set. Four volumes covering various phases of surgery have appeared: two on surgical treatment of the motor skeletal system, one on surgical treatment of the nervous system and one on surgical treatment of the soft tissues. The present volume which is a complete revision of the original edition is the fifth of the series.

The title of *Surgical Treatment of the Abdomen* belies the scope of this work since there is a section of 145 pages on anesthesia, one of 142 pages on the principles of surgical technique and one of 101 pages on surgery of the mouth including the salivary glands and the esophagus. This is not offered as a criticism of the work but of the title. In fact, the chapters on anesthesia are so comprehensive and lucid that any surgeon would do well to read them. At the operating table just one person is responsible and that is the surgeon. He should know the principles of anesthesia and the facts about any or all that are afforded him. An interesting detail described is the relationship between preoperative sedation and anesthetic used. The pharmacological actions of each agent are described again giving the why for the decisions.

**SURGICAL TREATMENT OF THE ABDOMEN.** By Frederic B. Bancroft, A.B., M.D., F.A.C.S., and Preston A. Wade, A.B., M.D., F.A.C.S. Philadelphia, London, Montreal: J. B. Lippincott Co. 642.

**THE NORMAL ENCEPHALOGRAM.** By Leo M. Davidoff, M.D. and Cornelius C. Dyke, M.D. 2d rev. ed. Philadelphia: Lea & Febiger, 1946.

A similar attitude can be taken on preoperative and postoperative treatment. This is well illustrated in a discussion of diabetes in the surgical patient. The problem is carefully analyzed a solution arrived at by common sense reasoning and presented in a concise manner requiring only a few minutes to read. The chapter on the fundamental principles of surgical technique written by the late Mont Reid and Stevenson deserves special attention. Here is described the correct ritual of the operating room. The attention to almost countless details many minor in appearance, which is so essential to a safe prompt and successful conclusion is described in full. One cannot but agree with the senior author when he states in the preface. It really should be read by every surgeon by every resident and by every intern. To this may be added— and adhered to.

Section four is devoted to surgery of the abdomen. The material is presented in a lucid and pleasing manner. Special attention may be drawn to the chapter on peritonitis and peritoneal abscesses by Collier and Ransom. The authors stress the reasons for their conclusions and advice. Chapter 15 on the surgical therapy of lesions of the stomach and duodenum was written by the late Roscoe R. Graham. Much informative material is presented which should guide the surgeon in the line of proper approach to the specific lesion to be treated. His discussion of the ulcer-cancer problem as related to the stomach is concise and definite and should be accepted. Stone in his chapter on the anus clearly demonstrates how a subject that is so frequently neglected and uninteresting to so many surgeons can be made not only interesting and informative but a pleasure to read. Ravdin in his chapter on diseases of the liver gives a concise description of this complicated problem as it is encountered today. His conclusions are founded upon sound scientific reasoning based upon research in this field and close observation on the human subject. The addendum to this chapter on portacaval anastomosis for the relief of portal hypertension by Blakemore is timely and most interesting.

Aside from the portions specifically mentioned this work of 1,026 pages contains chapters on abdominal incisions by Gurd the significance of gastroscopy for the surgeon by Schindler gastrojejunal ulcer by Pfeiffer surgery of the small intestine by Allen and Welch appendicitis its surgical treatment by Ochsner the colon and rectum by Rankin and Graham surgery of the biliary tract by Whipple diseases of the pancreas by Parsons, surgery of the spleen by Rives and Mace and physiologic aspects of post operative care by Bassler. The material is well arranged. It is enriched by 457 illustrations and 3 colored plates all of excellent quality. Such a large field is difficult to cover completely so that material is in a sequential order and unnecessary repetition is eliminated. The editor has accomplished this in a very commendable manner. The impression gleaned from the work is that in many ways it is a leader in a type of presentation that stresses not only what to do but why.

The chapters by Reid, Graham and Gurd cannot be read without becoming acutely aware of the stupendous loss the profession has sustained in the passing of these great surgeons, scholars, scientists and courteous gentlemen.  
JOSEPH A. WOLFE.

THE textbook *Lehrbuch der Gynaekologie* is the first volume of a three volume series of texts covering the field of gynecology and obstetrics. It has been developed since the war in order to fill the gap which was a result of the apparent loss of much of the textbook material, especially for the practitioner and student. Professor Guggisberg, director of The University Women's Clinic at Bern, has compiled the text and is the author of seven chapters. Professors Hintzsche, F. Ludwig, C. Müller and Neuweiler contribute the remaining twenty-one chapters.

In this large volume a tremendous amount of material is presented in an orderly, but rather uninteresting fashion. One is immediately aware of the complete absence of any bibliography and the scarcity of any reference to individual work. From the student's standpoint, this would be a rather prominent deficiency in that more extensive study of a specific subject would be impossible with this text as a basis. An extenuating circumstance in regard to this deficit may be the lack of reference material in Germany at the present time. Another rather noticeable omission is that of the detail of operative technique and operative therapy. In general this lack is of little moment to the student or practitioner. However, the more common procedures of hysterectomy and repair should be included.

The caliber of the illustrations in this volume varies considerably. The color photographs are little short of remarkable in detail and subject material. The most striking examples of this art are to be found in the chapters on diseases of the vulva and vagina, carcinoma of the cervix and myoma. These would be outstanding in any book. On the other hand many of the black and white and line drawings are indistinct and too diagrammatic to be of much value. The photomicrographs are in general rather poor although those which were taken of the early malignant changes in the cervix are well done.

The arrangement of chapters in the first half of the volume follows the usual lines. Anatomy, embryology and congenital malformations are covered adequately. The drawings are poor but hysterograms are good. Constitutional and growth disturbances, physiology and functional disturbances are discussed most completely by Guggisberg. The chapter covering the abnormalities of menstrual flow, disturbances of secretion and pain is extremely well done. Here again however is a photomicrograph of "glandular cystic hyperplasia of the endometrium" which to all the world looks like an advanced secretory endometrium. The pathogenesis of the organic and

*LEHRBUCH DER GYNAEKOLOGIE.* By Prof. Dr. Hans Guggisberg. Band 1. Stuttgart 1946.

functional disturbances and diagnostic procedures conclude the chapters on general topics.

Muller's material on diseases of the vulva and vagina and Newweller's on diseases of the uterus are certainly to me the best in the text and of this group the discussion of myomas with therapy is outstanding. Here also are to be found the beautiful color photographs which add much to the value of the work. Interesting to note here is the use of intra-cervical and intrauterine sclerosing solutions as part of the treatment of abnormal uterine bleeding. Also the mortality figures on the Wertheim procedure are those of past years. Meigs, his coworkers, and others have improved materially on the 15 per cent quoted by Newweller.

Diseases and tumors of the ovary are covered briefly. Incidence of malignancy is missing in cases of special tumors. The classification is as good as the majority of classifications of ovarian tumors. Diagnostic points are well taken. Discussion of diseases of the tubes is quite brief. Tubal pregnancy is not included here and is only mentioned in several other chapters. Possibly it is covered in another volume.

Infections of the genitalia, malpositions of the uterus and endometriosis are separated from other discussions of diseases of the genitalia by chapters on extragenital lesions associated with gynecological disease. Diseases of the pelvic connective tissue, abdominal wall, and intestinal tract are mentioned briefly. A 60 page chapter on diseases of the urinary tract attempts to cover urology with the result that many of the subjects of major importance to the gynecologist are dismissed with but a few words.

There is a short discussion of internal and external endometriosis with only a few inadequate lines on therapy. Sterility is covered well with extremely clear hysterosalpingograms and a good dissertation on examination of the semen. Contraception is also included in an excellent manner.

In the concluding chapters hormones, radiation and physiotherapy, diet, vitamins and hygiene of the female are given adequate discussions.

This voluminous text certainly covers the field of gynecology adequately with but few exceptions as noted. Subjects such as sterility, contraception, diet and vitamin therapy and hygiene are welcome additions from the standpoint of the practitioner. This book is more worthwhile from this standpoint than the average. From the student's viewpoint, the lack of references and inadequate treatment of operative therapy are detrimental omissions. For anyone in the practice of medicine the color photographs deserve very favorable comment. If the photomicrographs and line drawings were up to their standard the book would be worthwhile from this standpoint alone.

J. DONALD WOODRUFF

FOR many years cardiologists were content with three limb leads as standard technique in recording electrocardiograms, as originally described by Einthoven. During the last decade chest leads were added and universally accepted.

In his book *Unipolar Lead Electrocardiography* Goldberger describes the newest variation in technique—the unipolar leads, originally developed in Wilson's laboratory in Ann Arbor, Michigan. The book is a brief monograph of theory and technique, modestly illustrated, and well indexed. It satisfactorily presents the author's concept of the new method, with his own variations.

The new method is presumed to offer new information by the electrocardiographic method of the position of the heart in the chest, rotation of the heart (clockwise and counterclockwise), bundle branch block, axis deviation, and ventricular hypertrophy. How practical and how necessary these are to the internists and cardiologists will be answered best by further experience.

CHARUCY C. MARKEE

THIS monograph *Essai de physiopathologie thyroïdienne* by Dr. Mahaux is sufficiently brief and well organized to serve as a guide for reviving European medicine and for its war-time graduates. It is scholarly enough to merit the approval of clinical investigators in the field of endocrinology in any country. The book comprises a few pages on fundamental studies of thyrostimulation in animals, a section on clinical studies of interrelated thyroid and pituitary disorders, and a larger portion which is devoted to the disorders and treatment of the thyroid gland itself. The sources quoted are international and well chosen. The opinions expressed, particularly with respect to the scope, advantages, and complications of the medical thyroidinhibitors, are in accord with those of the best qualified American students in the field of thyroid diseases.

EDITH B. FARRINGTON

THE monograph of 206 pages *Retropubic Urinary Surgery* is of general value in drawing attention to the possibility of surgical approach by way of the space of Retzius. Millin states that his experience in the treatment of vesical neck obstruction by means of suprapubic (transvesical) perineal, or transurethral surgery has been, in the main, unsatisfactory and he was prompted to seek an improved method. He believes that the retropubic operation which he has devised and popularized answers the need for the improvement he was seeking.

The "cavum Retzii" as he calls it, has been avoided by most surgeons in developing a technique for suprapubic operative procedures. Millin believes that when adequate drainage is provided the retropubic space is no more vulnerable to persistent in-

UNIPOLAR LEAD ELECTROCARDIOGRAPHY: INCLUDING SINGLE AND LEAD V. UNIPOLAR EXTREMITY LEADS AND MULTIPLE UNIPOLAR PRECORDIAL LEADS. By Emanuel Goldberger, B.S., M.D. Philadelphia: Lea & Febiger, 1947.

ESSAI DE PHYSIOPATHOLOGIE THYROIDIENNE: ETUDE CLINIQUE, THYROIDECTOMIE ET HYPOPHYSECTOMIE. By Jacques Mahaux. Paris: Masson & Co., Editeurs; Liege: Editions Doctor, 1947.

RETROPUbic URINARY SURGERY. By TORRELL MILES, M.A. M.Ch. (Dub.) F.R.C.S. F.R.C.S.I. Baltimore: The Williams & Wilkins Co. 1947.

fection than is the paravesical region. No persistent infection no osteitis pubis or osteomyelitis of the pubis has been noted by him in any of his patients. He ascribes this complication to injury of the pubic periosteum although many instances of both osteitis pubis and osteomyelitis have been reported in this country following operations upon the bladder and prostate.

Millin recounts the experience of performing 375 prostatectomies since 1945 and his statistics surely indicate that his results have been as good or better than the average similar experience by skillful operators who utilize either the suprapubic or perineal approach.

He reviews the orthodox and accepted views of bladder neck pathology and deals conservatively with preoperative preparation and treatment. A series of brief case reports are included in a short chapter on fluid balance principles.

Millin stresses the ease with which the operation of retropubic prostatectomy can be performed if certain new instruments he describes are used. Post operative complications are listed rather as possibilities than actual experience in Millin's series. He reports only one instance of major hemorrhage after operation and this is certainly a low incidence.

Millin lists other conditions as suitable for surgical treatment by the retropubic route such as the fibrous and calculeous prostate, the malignant prostate and rupture of the posterior urethra. Strass incontinence in women is also treated by a rather complicated operation. The author states that he has performed this latter procedure in over 60 cases during the past 3 years with the most gratifying results. No amplification of this statement is given.

It seems questionable to accept Mr. Millin's enthusiasm in applying this operation to the fibrous prostate and other vesical neck obstructions of minor prostatic enlargements. Transurethral resection achieves an excellent result in these patients with less subjective upset. If Young's insistence, in carcinoma of the prostate on a total removal of the seminal vesicles and their related fascia is accepted as true and essential by advocates of radical perineal prostatectomy in America, Millin's procedure can not satisfy this criterion in carcinoma of the prostate.

Millin gives the impression of having a great personal enthusiasm for his work and undoubtedly has developed a most meticulous technique. He is a very skillful surgeon. The monograph gives the impression of having been compiled rather hurriedly and without the scientific, detailed case analyses which we would like to study.

Millin has undoubtedly made a valuable contribution to prostatic surgery. Time must elapse before a scientific evaluation of retropubic prostatectomy can be made. In the meantime many men will be operated upon by this method and large numbers of patients can be studied carefully so that the end results and late complications of these groups can be compared to similar groups treated by the suprapubic (transvesical) and the perineal routes. These two

latter methods, despite their drawbacks have persistently been the routes of choice by most surgeons for more than a generation. VINCENT J. O'CONNOR.

THE text *Operative Gynecology*<sup>1</sup> by Crossen and Crossen has been revised and renewed extensively. Despite the alterations that have been made the present edition the sixth contains about 75 less pages than the fifth edition. Actually new operations and more illustrations have been added. Many of the historical notes on operations, which appeared in the earlier editions have been deleted or condensed.

The section on radiotherapy is noteworthy in its discussion of the management of myoma uteri. Gratifying results can be obtained when great care is exercised in the selection of suitable cases for this type of treatment. With the recognition of definite indications and contraindications, irradiation therapy can prove to be a valuable addition to the gynecologist's surgical skills.

Prevention of carcinoma is emphasized and treatment of the diseased cervix is particularly stressed. Carcinoma *in situ* (intraepithelial carcinoma) is not mentioned or discussed. All gynecologists will not agree that the involuting uterus and ovaries should be removed in each case in which any one of the pelvic structures requires operation.

The chapters on anesthesia and the intestinal tract in relationship to gynecology have been well revised and rewritten by H. S. Brooks, Jr.

The volume has been carefully and thoroughly planned and well deserves to be a standard reference for the gynecologist. GEORGE A. HAINES.

THE book *Rheumatism and Soft Tissue Injuries*<sup>2</sup> by James Cyrilax, deals with painful soft tissue lesions. Lesions of the fascia, bursae, tendons, muscles and ligaments, of obscure etiology and appearing for no obvious reason have been classified under the rather broad term rheumatism. The author attempts to clarify the nature of these vague pathologic painful conditions by a system of diagnostic measures based upon clinical findings. The localization of the lesion to a definite tissue is based on a logical system of examination.

The book is divided into chapters dealing with various anatomic divisions of the body with methods for examination of each part. Appropriate treatment, chiefly physical therapy is discussed in detail for each lesion and part involved.

Many theories are advanced to explain obscure pathology and these may be accepted or rejected by the reader according to his view.

The book is well illustrated with line drawings and excellent photographs and should be of interest to physical therapists and those specialists dealing with the musculoskeletal system. WILLIAM A. LARMON.

<sup>1</sup>OPERATIVE GYNECOLOGY. By Harry Sturgeon Crossen, M.D. and Robert James Crossen, M.D. 6th ed. St. Louis. The C. V. Mosby Co., 1948.

<sup>2</sup>RHEUMATISM AND SOFT TISSUE INJURIES. By James Cyrilax, M.D. B.C. (Cantab.). New York and London: Paul B. Hoeber Inc., 1946.

A NEW edition of the well known and practical *Textbook of General Surgery*<sup>1</sup> has been brought up to date by the authors and nineteen collaborators and represents one of the finest textbooks available for the student of general surgery.

The subject matter emphasizes the fundamentals of physiology and pathology. There are many excellent illustrations of gross and microscopic pathology. The diagnosis and treatment of conditions encountered in the realm of general surgery are discussed in a manner both concise and adequate.

The material on nutritional requirements of surgical patients has been expanded in keeping with the growing interest in this field. There is an excellent chapter on surgical diseases of the chest. The section on war and catastrophe surgery has been rewritten and is a valuable chapter on military surgery.

For the most part surgical procedures are not described in too great detail, but this does not detract from the book's value as a text. The fundamental principles of surgical treatment are clearly defined and each chapter is terminated by a well chosen and up to date bibliography which affords an excellent reference list. EDWARD W. GIBBS.

THE author's long experience in the radiology of the gastrointestinal tract gives him a peculiarly valuable preparation for the production of this reference and textbook on *The Digestive Tract in Roentgenology*<sup>2</sup>. The text is complete. A very gratifying inclusion is a well selected list of references to the literature appended to each chapter. For the most part the illustrations are satisfactory. Some of the poorer illustrations are of rare cases in which the author had little choice. Careful perusal of this book impresses one with its value as a cyclopedic discussion of the subject of radiology connected with the digestive and biliary tracts. All things considered, this work probably rates as the best publication on radiology of the digestive tract in any language up to the present writing. JAMES T. CASE.

THE author presents a simple clear essay to follow a low discussion in his book entitled *Coronary Heart Disease*<sup>3</sup>. In the introductory chapter he states that the progressive increase of this disease during the past 45 years has been the principal factor in the rise of heart disease to the leading place as a cause of death in this country. Ernestine continues with a general statement covering the difficulties of diagnosis which often arise followed by a brief but concise

discussion of the fundamental causes of the disease and the important changes in the electrocardiogram which corroborate a diagnosis.

The remaining chapters in the book are devoted to the principal clinical manifestations of coronary heart disease: angina pectoris, acute myocardial infarction, acute coronary failure, paroxysmal cardiac dyspnea (cardiac asthma), auriculoventricular and intraventricular block, other disturbances of cardiac rhythm and congestive heart failure. The conditions are clearly presented with their distinctive clinical picture or diagnostic changes in the electrocardiogram and the treatment of each as it differs in important respects from that of the other.

The discussion of each condition is clear, logical, and comprehensive in the limited number of pages. One very important feature is his free use of excellent references from the medical literature, chiefly of recent date. In addition his discussion of the use of various acceptable forms of treatment is highly adequate and should prove most helpful to the practitioner. GEORGE C. TURNELL.

THE increasing interest shown in respiratory physiology in its relationship to the application of inhalation therapy makes *Physiologic Therapy in Respiratory Diseases*<sup>4</sup> particularly timely. A general review of anoxia and its treatment is followed by a practical application of these physiologic principles to the management of the most common conditions in which alterations of normal gaseous exchange occur. The interrelated use of aerosols and their role in the treatment of these pathologic processes is presented. Problems in aviation and war medicine are discussed and a practical, simple yet detailed description of the methods and apparatus for inhalation is presented. Contributions to the current literature in regard to apparatus and methods have been numerous and this compilation makes a valuable reference compendium to the subject not only in recent developments but in such established apparatus as oxygen tents, masks, respirators, oxygen analyzers, etc. Clear illustrations, charts, and case histories, and chapter bibliographies add to the clarity of presented data. Of particular interest is the discussion of the equalizing pressure chamber and its role in the management of pulmonary tuberculosis, particularly in those cases hitherto classified as "hopeless."

Although this book is of special interest to the anesthesiologist, internist and surgeon it should be of value to those in all fields of medicine. There are few specialists who would not find something of practical interest in this book. It should be of broad interest to all practitioners. EDWARD BIGGS.

*PHYSIOLOGIC THERAPY IN RESPIRATORY DISEASES.* By ALVIN B. BERNHARD, M.D. 2nd ed. Philadelphia, London, and Montreal. J. B. Lippincott Co., 948.

*TEXTBOOK OF GENERAL SURGERY.* By WALTER H. COLE, M.D., F.A.C.S., and ROBERT ELMAN, M.D., F.A.C.S. 15th ed. New York and London: D. Appleton Century Co., Inc. 948.

*THE DIGESTIVE TRACT IN ROENTGENOLOGY.* By JACOB BUCHHEIM, M.D., Philadelphia, London, and Montreal: J. B. Lippincott Co., 948.

*CORONARY HEART DISEASE.* By A. C. ERNSTINE, M.D. Springfield, Ill.: Charles C. Thomas, 948.

# SURGERY

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*Supplement*

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# INTERNATIONAL ABSTRACTS OF SURGERY

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## COLLECTIVE REVIEW

### HISTORICAL ASPECTS OF PENETRATING WOUNDS OF THE ABDOMEN

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SINCE prehistoric times the abdominal cavity has been looked upon as one of the most vulnerable regions of the body and injuries involving it have always been considered very serious. The lethal character of a wound which opened the abdomen was well known to the ancients. Not infrequently the military surgeons or in their absence, the war chiefs or commanders serving as surgeons were required to remove arrows or spears implanted into the abdomen or if these did not pass entirely through the cavity to pull them through the opposite side. Usually unsuccessful efforts were exerted to remove inaccessible arrowheads from the cavity by the use of drawing plasters. The Ionian Greeks referred to the physician as the *inpros* meaning an extractor of arrows.

From the Homeric epics we learn of the death of Polydorus (13) at the hands of Achilles, whose weapon on entering the back of Priam's son made its exit in front, and the victim bending clasped his bowels in his hands and while Troas (14) begged for his life, Achilles thrust

His sword into his side the liver came  
Forth at the wound the dark blood gushing filled  
The Phrygian's bosom

We learn also of Eurymachus (16) who succumbed to the effects of a liver wound which was inflicted by an arrow from the powerful bow of Odysseus.

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Hippocrates (1) postulates that a severe wound of the bladder of the small intestines of the stomach and of the liver is deadly. Xenophon (112) in his *Anabasis*, speaks of a Greek captain who after being wounded made his way back to camp holding his bowels in his hands. Every indication points to a number of abdominal wounds among the twenty three inflicted, suffered by Julius Caesar (15) at the hands of his numerous assassins.

Although murder by stabbing was chiefly superseded by poisoning during the Dark Ages nevertheless, the dagger arrow lance, spear, and sword continued to account for many frequently fatal penetrating wounds of the abdomen. The 'Age of the Despots' in Italy is replete with assassinations in which the dagger was usually the principal weapon used. Galeazzo Maria (103) Duke of Milan in 1476 died immediately as the result of almost simultaneous stab wounds of the back chest, and abdomen.

The self-disembowelment of the Japanese, known as *hara kiri* (26) is a vestige of old feudal Japan which has come down as a national form of honorable suicide. After the preliminaries in the ritual the suicide plunges a dagger into the left side of his abdomen below the costal margin draws it slowly across to the right, and finally turns it up giving a sharp upward cut. This procedure is looked upon as wiping out all dishonor—a thought not foreign to our present day Western civilization—and probably a means of faccaving so important to the Japanese mental complex.



## INTRODUCTION OF GUNPOWDER AND FIREARMS

Although 1354 is given as the year in which gunpowder was introduced in Europe by Schwartz (27) it is very likely that gunpowder was known to the Europeans long before this time, as powder works are described at Augsburg in 1340 and gunpowder was known in Florence as early as 1326. The early and very crude firearms, the first invention of which is attributed to Schwartz, no doubt appeared soon after the introduction of gunpowder. Certainly at the battle of Cressy (84) in 1346 the bowmen were arranged in such a way as to have small bombards between them which with fire threw little iron balls to frighten the horses." Louis XI of France (1477) used bombards of great length and power some with stone balls and some with iron. "Wounds inflicted with such primitive firearms were very probably in the nature of bruises or contusions, very few possibly ever penetrating the surface of the body."

The pistol, which was the predecessor to the modern revolver and automatic, is said to have been invented in Pistola, Italy probably between 1475 and 1500. The revolver an improvement over the two and three barreled pistols, made its appearance early in the seventeenth century while the first automatic was introduced in 1893. Since the invention of these three weapons the greatest number of gunshot wounds of the abdomen in civilian life is traceable to them. The old musket and its descendants, the shotgun and rifle, as well as the highly efficient machine gun (so commonly used by gangsters in this country in the twenties and early thirties) are relatively infrequently used in civilian life as a means of assassination. In military undertakings today the revolver and automatic probably cause fewer abdominal injuries than the rifle, machine gun, hand grenades, shrapnel, splinters of shells and bombs, and fragments from other contrivances. Each new weapon introduced has been featured by an increased velocity of the missile used, and each has been devised for a more certain and greater destruction of the object struck. From all indications, therefore, probably very few if any penetrating abdominal gunshot injuries were seen before 1400 and since then they have not only been on the increase but the wounds inflicted have been of the more disastrous types—this in spite of an improvement lately reported in the mortality rate among the victims of these injuries (22, 23, 40, 47, 63, 80, 91, 93, 100).

The introduction of firearms made available a means of assassination in which the assailant was relatively free from the possibility of injury at the hands of the victim, an immunity which he

did not fully enjoy in assassination by stabbing, especially if the intended victim was larger and stronger than the assailant. However the introduction of firearms did not eliminate homicide by stabbing. Lances, swords, and daggers continued to enjoy their ancient popularity. Arrows with their bows became obsolete in Europe shortly after the invention of firearms. Spears very probably gave way to the bows and arrows many years before the introduction of gunpowder and the dagger is still with us. Stab wounds today however are usually inflicted with large knives of various types or ice picks which have relatively recently become very popular. At the New Orleans Charity Hospital there were admitted during the 15 years prior to January 1, 1941—478 cases of penetrating abdominal gunshot wounds, 85 per cent of which were due to revolver shots, and 330 cases of penetrating stab wounds of the abdomen, the majority of which were inflicted with various types of knives.

## EARLY TREATMENT OF PENETRATING ABDOMINAL WOUNDS

The ancients usually washed all wounds carefully with warm water after which they were examined more thoroughly. Wine was given as a stimulant. Spears and arrows were withdrawn or excised. The wound was treated further with oil or wine, or with root juices, and was protected with a woolen dressing. Certain herbs, known to relieve pain, were used freely, and the wounded were kept at rest in tents. Early in the Dark Ages there began the custom of using boiling oil and hot irons in the treatment of wounds. To these were added greasy salves and plasters. This abominable and barbarous treatment was finally stopped by Ambroise Paré (1510-1590) when he accidentally ran short of oil and thus discovered that other much less painful and less barbaric methods were not only more comfortable, but likewise more beneficial. In the treatment of gunshot wounds, which were becoming fairly common injuries by this time, Paré introduced the practice of searching for the ball, using "large and deep incisions" (43) if necessary.

That the problems connected with the proper management of penetrating abdominal wounds were difficult is attested to by the following recommendations by Jerome of Bruynswyke (19) who in 1525 taught

"When the guttis is wounded oerthwart or in pecis, than it is deadly: yf it be lengthe woundyd, it may be holpen. If that the wounde of the belly is not grete inowgh, than shall ye make it greater

as I shall shewe you hereafter than shall you take out propley the guttes, and sow it thereafter as it is needful with a skynners nedyll. Jamericus Theodoncus Rogerius lay elder pypes in the guttes under the seme, that the same rotte not. Whilhelmus and some other lay there in a part of a cryer of a throte goll of a beest, as the IV maysters sayth. But Lanfrancus and Guido they thinke it not be profytable for that nature is inclyned to outdrawinge strange thyngys, and thus yt helpt not therefore it was layd, and it is better that the guttes be sowyd as afore is sayd and that it be clensyd of the unclenes.

For very obvious reasons these recommendations were soon forgotten and the treatment of penetrating wounds of the abdomen became very conservative. Hence, from about the middle of the sixteenth century to well on in the nineteenth century when Sims and others began recommending intervention in cases of penetrating wounds of the abdomen—especially those caused by fire arms—these injuries were treated by rest, opium dressings, and protection of the wound with wine or brandy as stimulants and frequent bleedings or venesections. Some feeding by mouth was at times allowed but most usually small quantities of liquid foods were administered by rectum. In addition Guthrie mentions the use of leeches, fomentations to the belly, calomel, blistering of the abdomen, and the judicious use of purgatives.

Venesections for bleeding or the practice of bloodletting (as this procedure was more commonly known) and the extensive use of leeches about inflammatory areas, were therapeutic measures enjoying great popularity up to perhaps 100 years ago. After a rather lengthy dissertation Guthrie explains that 'when great inflammatory fever or inflammation come on either of which is a great increase in action, the patient can bear it for several days without any permanent detriment, provided he lose blood in proportion to the increase of action, in order to prevent its destroying the texture or function of any vital part. If this be not done, the patient must be very soon carried off because the action will increase so rapidly as to be soon incompatible with life, unless relief be obtained. The amount of blood to be removed usually depended upon the time that relief from pain occurred during the treatment by this bloodletting. Ordinarily the removal of from 12 to 25 ounces was recommended.

The practice of probing penetrating wounds very probably dates from antiquity. When fire-



Fig. 1. Ambroise Paré (1510-1590) "father of modern surgery" (at 75) who introduced many new practices in the military surgery of his time including the use of the ligature to control hemorrhage instead of hot oil and the cautery (Ambroise Paré and His Times, 1510-1590, by Stephen Paget. New York and London G. P. Putnam's Sons, 1897)

arms were improved to the point of producing penetrating wounds the attendants placed much importance on probing to remove the missile, if possible. Later in addition to determining the location of the bullet for its possible removal, the probe was used to trace its course. In this way a more accurate diagnosis of the structures or viscera injured was considered likely. The use of the probe as a diagnostic instrument continued until the very early years of the present century when the practice was condemned as dangerous.

#### LATER TREATMENT

The ultraconservatism practiced in the management of penetrating abdominal injuries continued practically unchanged until Sims began emphasizing the need for laparotomy to repair the damaged structures in these cases, particularly in gunshot wounds. Prior to this, Baudens suggested bold operations in some cases of penetrating



Fig. 2. James Marion Sims (1813-1883). American surgeon. Strong advocate of surgical intervention in penetrating gunshot wounds of the abdomen. ("Surgery of Modern Warfare" in Hamilton Bailey, B. Baltimore: The W. B. Saunders Co. 1944.)

gunshot wounds of the abdomen, having performed enterorrhaphy in 2 cases of abdominal gunshot injuries during the French Algerian War 1830 (98) after which one of his patients recovered. Baudens, accordingly, enjoys the distinction of probably having been the first to perform laparotomy for penetrating abdominal gunshot wounds. During the Crimean War this surgeon advised the introduction of the finger or a small sponge through the enlarged penetrating abdominal wound to determine the presence or absence of blood, feces, or bubbles of gas (67) in the absence of which he recommended abstinence.

It was not very long before the views of Sims, the leader of the interventionist movement in the treatment of penetrating abdominal gunshot wounds, were upheld by many other surgeons, particularly in America and Germany. The leader of the abstentionist group, which was particularly strong in France, was Réclus (83) whose experiments on dogs and whose report of 66 recoveries in a series of 88 abdominal wounds treated conservatively were especially convincing to his followers. He advised laparotomy only in those cases in which the signs of visceral injury were unmistakable. However the writer believes that Réclus convincingly favorable results were possible because of the much smaller caliber of the missiles used in the French guns of that day whereas, the

guns in America, Germany, and England were probably of a larger caliber and the bullets, therefore, very likely, produced much more damage to the tissues involved.

A symposium on penetrating abdominal gunshot wounds, held by the American Surgical Association in May 1887, concluded with the consensus of opinion in favor of the operative treatment, even in those cases in which the diagnosis of injury to important intraperitoneal structures was in doubt. At this meeting Nancréde a splendid paper covered the subject of laparotomy excellently. In spite of losing 2 of his 3 patients, it was his opinion that the advantages of operation are manifold. On the same day case reports by Kinloch, who is credited with having operated upon the first penetrating abdominal gunshot injury in this country, and by Keen, were followed by a general discussion with additional illustrative case reports of penetrating gunshot and stab wounds by Conner, Gunn, Ellice, Richardson (who reported from the New Orleans Charity Hospital), Agnew, (who had been a consultant in the gunshot wound case of President James A. Garfield), Dandridge, Ransohoff, and Roberts. In his paper Kinloch quoted statistics by T. S. K. Morton, in which the latter (after a careful study of the world literature) gave reports of 57 cases operated upon for abdominal trauma up to that time (January 26, 1887). Among these there were 22 gunshot wound cases with 17 deaths—a mortality rate of 77.2 per cent. Kinloch further points out that Walter performed the first abdominal section for traumatism in America followed by his first case in 1863. Walter's case was that of a 22-year-old blacksmith who was kicked over the pulvis while in a fight. Because of excruciating pain exploration was advised. This was done in January 1850, several days after the fight. A urinary bladder laceration 2 inches long was found. Urine and blood were removed from the peritoneal cavity. A retention catheter was placed in the bladder and kept there 3 weeks. The patient recovered.

In an editorial entitled "Laparotomy in Gunshot Wounds of the Abdomen" (24) appearing in the Journal of the American Medical Association on January 12, 1889, the subject was reviewed very thoroughly and the opinions of the various writers of that day were given. After consideration of the recommendations of Réclus, in which the noted French surgeon advised (1) firm compression of the abdomen to check hemorrhage and fecal extravasation, (2) administration of large doses of opium, and (3), failing in this, laparotomy—the editorial concluded by giving the impression that its writer was in total disagreement

with Réclus on several points, and took the stand that intervention is almost invariably to be preferred to passive treatment in these cases.

Despite the trend of surgical opinion in America the results, following the adoption of the active or operative treatment, were for many years practically no better than those following conservative treatment. Thus, in 1889 Barrow reported laparotomy in 4 cases with 1 recovery—a case in which no visceral nor other important structural injuries were found. Somewhat prior to this, Morton reported a mortality rate of 77.2 per cent. The tendency toward intervention was so convincing however that at the start of the Boer War (32) (1899-1902) the British advised laparotomy in all cases of penetrating abdominal wounds when there was reason to believe intestinal injury existed. However a study of the results shortly after the onset of hostilities showed that the mortality was greatest among the patients treated by laparotomy. Accordingly during the remainder of the war conservatism was the order of the day. This British military order remained in force through the early months of the first World War not being rescinded until 1915 at which time a study of the cases of penetrating abdominal wounds showed the need for intervention. It is believed that a smaller type of bullet used by the Boers in the South African War obviated the need for laparotomy in many cases of intestinal perforation inasmuch as the small openings produced were easily closed by the intestinal mucous membrane. However during World War I the larger missiles, as well as a greater and more damaging variety of them produced larger perforations and more extensive lacerations. These necessitated intervention if there was to be any hope of recovery.

During the Russo-Japanese War (1904-05) the policy of conservatism was soon replaced by one of intervention following the innovation by Princess Gedroitz (32) who organized and equipped a railway carriage operating unit in such proximity to the battle front that it was possible to operate on penetrating abdominal wounds within a period of three or four hours of their being sustained. The Russian Army authorities were in this way convinced of the great importance of time in these cases and advised continuation of this practice.

Thus the interesting indecision on the part of the Surgical World as regards active or passive treatment in penetrating wounds of the abdomen continued for 55 years. Early in the first World War the mortality in these cases was frightful. This represented the period of nonintervention in this conflict. Later however when the victims were treated and operated upon in the clearing

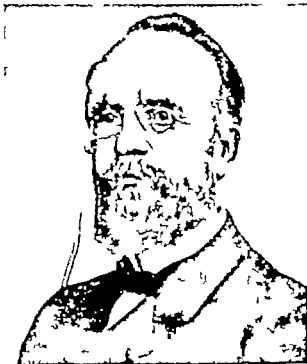


Fig. 3. Paul Réclus (1847-1914) French surgeon. Leader of the abstentionist group in the treatment of abdominal gunshot wounds ("Surgery of Modern Warfare" by Hamilton Bailey, Baltimore: The Williams and Wilkins Co. 1944.)

stations nearer the front, the mortality dropped to around 56 per cent (108).

Although the matter of active or passive treatment in penetrating abdominal wounds occupied the attention of and appeared to be of paramount importance to surgeons for many years, not much was otherwise done in the management of these cases. Infusions of saline solution and glucose, although known, were rather infrequently used before the present century. The Matas (71) continuous intravenous drip of glucose, like the ordinary infusions of saline solution (68) and glucose has only relatively recently been used in these cases of trauma. These procedures have proved to be indispensable adjuvants in the treatment of patients with penetrating wounds of the abdomen.

As regards the operability or fitness of a patient with a penetrating abdominal gunshot wound for exploratory celiotomy the rule taught by Matas (70) to his military classes in 1916 to 1918 at the New Orleans Charity Hospital very probably applies as well today as it did then except that blood and especially plasma transfusions are now easily substituted for the saline-glucose-adrenaline continuous intravenous drip which was then used. His rule was that no surgical exploration should be undertaken until the patient shows signs of having reacted from shock.

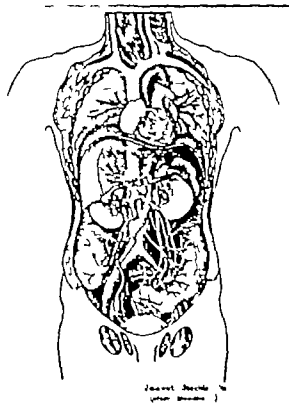


Fig. 4. Diagrammatic sketch emphasizing the location of the large intrathoracic and intra-abdominal blood vessels, injury to any of which may result in sudden death.

In all cases of penetrating gunshot wounds in which the patients were brought to the hospital "in a state of collapse from shock or hemorrhage, or both" the first step was to deal immediately with the collapse by using the continuous saline-glucose-adrenaline intravenous drip, which Matas first introduced in New Orleans in 1910 as an improvement over the massive repeated infusions (which were likewise first used by him in New Orleans in 1888) and as a substitute for the uncertainties of the Murphy rectal saline drip which had been in vogue in abdominal practice since the beginning of the century. While the intravenous drip was in progress, the usual other measures in the treatment of shock and collapse were applied, and all preparations were made for the exploration. However no incision was made until the patient showed signs of cardiovascular reaction to the stimulating and resuscitating effects of the warm saline-glucose-adrenaline drip infusion. With the first signs of returning animation, as shown by the color, temperature, pulse rate, blood pressure, consciousness, and pupillary reactions, the exploration was immediately undertaken in

the effort to control hemorrhage as the first indication. If the patient failed to react to the intravenous infusion, operation was considered useless "as shock was the preponderating feature of the collapse, and any added trauma would certainly precipitate a fatal issue on the operating table.

In the cases showing hemorrhage as "the dominant feature of the collapse" the pulse and general condition would improve with the increasing blood volume supplied by the infusion, and an exploration could then be performed while the drip was going on with the expectation at least of survival of the patient from the operation.

The first use of a blood transfusion in penetrating abdominal gunshot wounds is credited to Fonio in 1918, although he ascribes priority to Agote. The use of transfusions in abdominal trauma has saved many lives which would have certainly been lost previously. For a good many years, the problem of securing donors (60) as quickly as needed interfered materially with this form of therapy. The recent introduction of blood plasma for intravenous use in the treatment of shock and hemorrhage, and the establishment of plasma banks in most modern hospitals, has helped very considerably to solve this problem. At present, therefore, with the liberal supply of blood, whole or citrated, and blood plasma, all of which are usually on hand in every moderny equipped hospital, the stimulating and resuscitating effects of the transfusion are far more quickly perceptible than when simple artificial sera are used, particularly if the blood transfusion is kept up as a continuous intravenous drip of indefinite duration, sufficient at least to compensate for the volume of blood lost. If a patient on the operating table is too deeply shocked to respond to this fundamental mode of cardiovascular stimulation, an operative procedure will not only fail to save the victim but will more than likely precipitate the end. Thus, today in addition to undergoing laparotomy almost routinely in these cases, the victim receives the benefits of prompt and adequate preoperative preparation, postoperative care, especially as regards the replenishment of fluids, electrolytes, plasma and blood, the all important vitamin therapy so essential in convalescence, and, lately the benefits of chemotherapy (63) (93) (46) which appears to help very materially in reducing the mortality among these victims.

In connection with the preoperative and postoperative care of these patients, too, the continuous drainage of the gastrointestinal contents by siphonage through an indwelling gastroduodenal tube, introduced by the nasal route, has proved

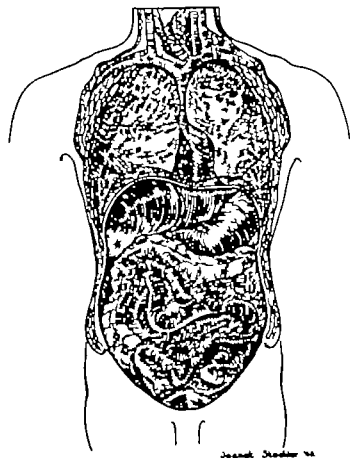


Fig. 5. Diagrammatic sketch emphasizing the relationship of the relatively more superficial anterior structures of the chest and abdominal cavities.

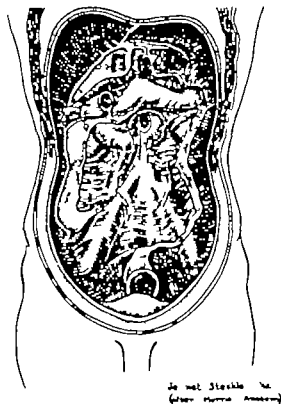


Fig. 6. Diagrammatic sketch emphasizing the positions of the retroperitoneal structures and the peritoneal cavity. Kidneys, ureters, adrenals, and duodenum are the structures more frequently injured, especially by penetrating abdominal gunshot wounds.

to be very valuable and indispensable. Nothing else in the surgeon's armamentarium is as effective in controlling vomiting and tympanites. Probably no other advance has contributed more materially to the comfort of these patients than this procedure, which was first introduced in the New Orleans Charity Hospital simultaneously with continuous intravenous drip by Matas in 1911 (71) in the treatment of intestinal obstruction. This same procedure, modified in 1931 (107) by the use of a suction apparatus for simple siphon age, is now known as the Wangenstein suction.

#### DIAGNOSIS IN ABDOMINAL TRAUMA

The introduction of the operative method of treating abdominal trauma particularly penetrating wounds of this cavity by Baudens in 1830 automatically created a great need for a more careful and more accurate diagnosis in all cases of trauma to the abdomen. For many years, the probe was one of the most important instruments in the surgeon's armamentarium. With it the course of a penetrating missile could more or less be traced. The use of this instrument as a diagnostic measure was considered good practice until

early in the present century, when many of its dangers were emphasized and its popularity consequently faded. Because of their conspicuousness, the entrance and exit points in penetrating or perforating wounds of the abdomen attracted attention from the earliest days. Extensive stab wounds especially those in which the weapon perforating the cavity showed itself on the opposite side, were easy to diagnose with respect to involvement of the abdomen. Smaller stab wounds were more difficult to diagnose as regards involvement of the cavity and its contents. It was in this type particularly that the probe was of much help to the diagnostician.

The introduction of firearms made the use of entrance points more difficult to understand. The early types of firearms did not propel the missile with a very great velocity. Not infrequently, removal of a piece of shirt or other clothing from a wound brought the bullet out along with it. Later, as the velocity of the missile increased this seldom happened. However, usually the course of the bullet was very difficult to trace after it had entered the cavity. An exit point would sometimes simplify the diagnosis. Frequently how

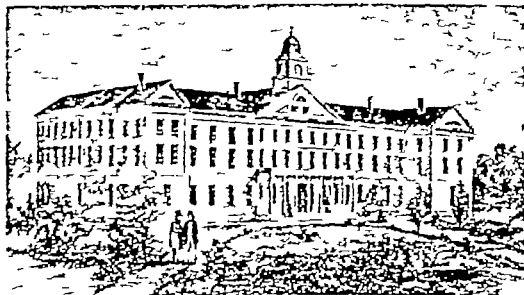


Fig. 7. Charity Hospital of Louisiana at New Orleans in 1899. This structure was only relatively recently demolished to clear the ground for the present skyscraper building.

ever exit points are not present. Occasionally because of ricocheting when striking tissues of varying densities, the missile takes a more tortuous course than is expected, and when the peritoneal cavity is suspected of being almost certainly involved it is found not to be. On the other hand, when no involvement is suspected the danger signs of some serious injury to important structures frequently follow. In general, however, the presence of entrance and exit points gives a fairly accurate idea of the course of a bullet and the structures possibly injured.

As pointed out by Bandens, when a sponge on a holder is passed through a small opening into the abdomen, the finding of free blood, feces, or bubbling gas in the peritoneal cavity is unmistakable evidence of injury to a blood vessel or the intestines. However evidence of this type is unusual, especially in abdominal penetrating wounds observed among civilians. Of great importance, too, but not infrequently misleading, are abdominal pain, nausea, and vomiting. This triad is very important, and usually points to visceral injury within the peritoneal cavity. A silent abdomen, on auscultation, is usually indicative of intestinal perforation. Pallor, a rapid pulse, thirst, and profuse perspiration point very strongly to possible active internal hemorrhage. Since the largest number of the patients die of hemorrhage (60) early diagnosis of this condition is most important. Every patient with abdominal trauma should be made to void or, if necessary, catheter

ized for the possible presence of blood in the urine. If indicated, a digital and proctoscopic examination of the rectum should also be done.

An important method of diagnosis, introduced by Lenk during the first World War, was the use of the fluoroscope for air under the diaphragm. The use of the x-rays to locate a missile as pointed out by Granger is likewise of value, since the course of a missile might frequently be reconstructed when it is properly located in the body. The recent use of the peritoneoscope by Hamilton in gunshot and stab wounds of the abdomen of doubtful penetration" has added another diagnostic method that may prove to be of value in the future. The great importance of a correct pre-operative diagnosis in these cases was universally appreciated during the recently ended World War II. Michels is of the opinion that this helps to explain the "superior" results thus obtained among these cases.

#### NEW ORLEANS CHARITY HOSPITAL

After a careful study of penetrating gunshot and stab wounds of the abdomen in patients admitted to the Charity Hospital of Louisiana at New Orleans, the author agrees with Matas (72) that, aside from an actual seat of war, possibly no other hospital in the world sees and treats as many cases of penetrating abdominal injuries as does this great medical institution. From January 1, 1927 to January 1, 1948 this hospital has admitted 1,352 cases of penetrating abdominal gunshot

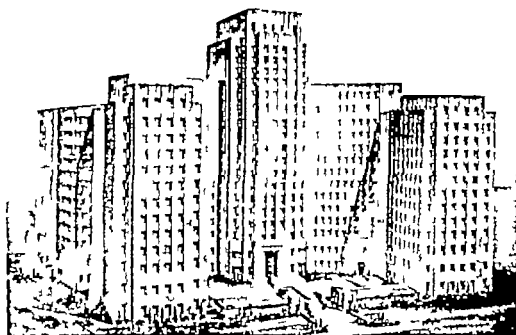


Fig 8 Charity Hospital of Louisiana at New Orleans as it appears today

and stab wounds, 685 of which were gunshot in juries. During this same time, 1,369 cases of penetrating gunshot and stab wounds of the chest were admitted, 968 of which were stab injuries. Thus over a period of 21 years this institution has admitted 2,721 cases of penetrating gunshot and stab wounds involving the chest, abdomen or both of these cavities.

This unenviable reputation quite naturally reflects the activities and tendencies of a section of the country in which a large proportion of the population are negroes. Accordingly among the 2,721 patients 2081 or 76.5 per cent, belonged to this race. Among the abdominal cases 69.2 per cent occurred in negroes. Hence the unusually large number of such cases seen at this institution is in great part due to the large negro population of this section.

The experiences at this hospital with these types of cases no doubt date back to its founding in 1832. Thus far however the first published record the writer has been able to find is a discussion by Richardson, Professor of Surgery in the Medical Department of the University of Louisiana (Tulane) at a symposium on abdominal gunshot wounds held by the American Surgical Association in May 1887. In his discussion, Richardson said that a large proportion of cases of penetrating wounds of the abdomen get well without laparotomy at the New Orleans Charity Hospital and further stated that during the previous 5 years (1882-1887) of the 31 patients admitted with knife wounds of the abdomen, 24 recovered, and of the 33 with

gunshot wounds involving this cavity 13 recovered. Additional studies and contributions on this subject from this institution were later made by Miles, to whom Matas (72) gives credit for inaugurating the operative treatment of these

TABLE I—SOCIOLOGIC ASPECTS OF VIOLENCE AMONG THE VICTIMS OF GUNSHOT AND STAB WOUNDS ADMITTED TO THE NEW ORLEANS CHARITY HOSPITAL FROM JANUARY 1 1900 TO JANUARY 1 1942

Type of Wounds	Total	Cases		Incidence Per cent
		White	Colored	
Penetrating gunshot and stab wounds of abdomen	774	665	1,090	8.7
Penetrating gunshot and stab wounds of chest	1,640	650	,05	5
Nonpenetrating gunshot and stab wounds of abdomen	1,567	135	70	4.0
Nonpenetrating gunshot and stab wounds of chest	2,115	630	1,008	7.0
Extra-abdominal and extra-thoracic penetrating gunshot and stab wounds (head neck)	3	74.7	1.5.5	66.8
Totals	31,715	0.739	1,004	69 colored 30.8 white
Average yearly	Cases 758			
Average monthly	63			
Average daily	2.1			

These figures do not include other types of violence as injuries with blunt weapons (blows from bars, clubs) poisoning nor does this include vehicular injuries.



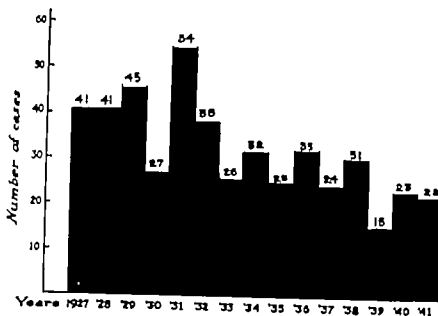


Fig. 9. Sociologic aspects of penetrating abdominal gunshot wounds in recent series (478 cases admitted to the New Orleans Charity Hospital from January 1, 1927 to January 1, 1942. The apparent decline in admissions during 1939, 1940, and 1941 may be due to the increased number of men between the ages of 20 and 40 being drafted into the Armed Forces during these years.

wounds at the Charity Hospital, Parker and Fennel Shands, Allen, Crawford, with relatively recent contributions by Loria (58, 59, 60, 61, 63) Miller and Storck (101) the latter two reporting on their personal cases.

In this connection, the writer is pleased to express his sincere and very grateful appreciation of the opportunities and encouragement for the study of abdominal gunshot wounds that he has derived from his honored chief, teacher and friend, Professor Rudolph Matas. It was while serving as clinical assistant on Professor Matas' staff at the Charity Hospital—during the time the writer had the privilege and honor of serving his surgical apprenticeship under him—that he was impressed with the importance of further study in this field of traumatic surgery. In 1925 the Charity Hospital Surgical Staff appointed a committee for the study of gunshot wounds of the abdomen. Dr. Matas was named Chairman of this Committee. All cases of abdominal gunshot wounds admitted to the institution during the years 1925 and 1926 were observed and carefully studied by the writer and yearly reports were made by the Chairman to the Surgical Staff (66). It was the study of these cases and the statistical work done during this time under Professor Matas' direction that have served as a foundation for the writer's later contributions on this subject.

Dr. Matas, assisted by Mr. Edward Hynes (79) was the first, in 1901, to utilize the collective Charity Hospital statistics for comparative racial incidence and mortality of abdominal gunshot wounds in relation to the population, and in comparison with other general hospitals of the same type in the United States and Canada, taking the statistics of the hospital in the decennium from 1890 to 1900 for this purpose. They found that the general State hospitals of the same type in New York, Boston, Philadelphia, Cincinnati, St. Louis, and Montreal had admitted a total of 205 cases of gunshot wounds of the abdomen during the decennium considered, while the Charity Hospital had admitted and treated 234 cases during the same period. It is interesting to note that among the 122 patients operated upon in this Charity Hospital series, there were 84 fatalities, a mortality rate of 68.9 per cent, whereas, among the 112 nonoperative patients, there were 60 deaths, a mortality rate of 53.6 per cent (69).

Recent studies by the writer (61, 63) of all cases admitted to this institution from January 1, 1927 to 1948 have revealed an enviable wealth of material, the analysis of which is still far from being complete. From January 1, 1900 to January 1, 1948, a total of 1,678 patients with penetrating abdominal gunshot wounds have been admitted to this institution for treatment. By adding the

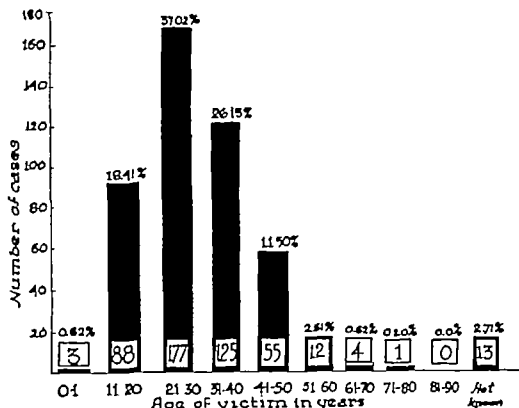


Fig. 10. Age incidence in the recently studied 478 cases of penetrating abdominal gunshot wounds at the New Orleans Charity Hospital. It will be seen that the greatest number of victims are between 20 and 40 years of age—nearly two-thirds.

234 patients admitted from 1890 to 1900 as reported by Matas (72) we find a total of 1912 patients with penetrating abdominal gunshot wounds treated at the New Orleans Charity Hospital over a period of 58 years—an average of about 33 cases each year. Recent studies on penetrating stab wounds of the abdomen show that 1,439 patients were admitted to this institution from January 1, 1900 to January 1, 1948. Hence, over a period of 48 years 3,117 patients with penetrating gunshot and stab wounds of the abdomen have been admitted to this hospital for treatment an average of 65 each year or 1 nearly every 6 days. It is not surprising then, that La Garde (72) during World War I jokingly suggested that the students in the Army Medical School should come to the Charity Hospital for part of their military training.

#### THE LATE SPANISH CIVIL WAR

A brief review of the literature dealing with this type of injury during the late Spanish Civil War is of particular interest mainly because of the appalling and frightful mortality rates reported (64.8-96) by the surgeons on each side. Sevilla summarized the experiences on the six most important sectors or battle fronts in the campaigns of the army under General Francisco Franco. The

lowest mortality rate reported by him 53.7 per cent, occurred among patients treated on the Northern Front. The highest mortality 71.8 per cent, occurred in the Teruel Sector. Baron, too reported mortality rates between 53 and 75 per cent for this type of injury. The figures reported by Jolly for this type of wound are no more encouraging.

Especially interesting is Jolly's observation that the majority of cases can be classified into three clinical groups.<sup>73</sup> According to him these three groups depend upon the signs and symptoms which indicate predominantly (1) an appreciable blood loss by the victim, (2) evidence of perforation of the gastrointestinal tract, or (3) evidence in which the dominating injury appears to be to the sympathetic ganglia and plexuses in the upper retroperitoneal region.

In discussing the prognostic factors Jolly emphasizes (1) the time lag (2) the type of projectile, (3) the physical condition of the wounded man before the injury (4) the site and direction of the wound, (5) the organ or organs affected (6) the conditions under which the operation takes place, and (7) the possibilities for blood transfusion as useful guides. According to Trueta the Spanish Civil War contributed "one development which is now universally accepted

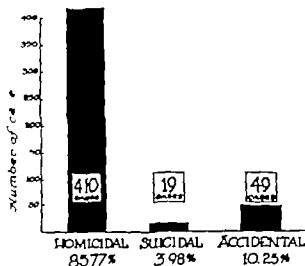


Fig. 1. Criminal status of the recently studied 478 cases of penetrating abdominal gunshot wounds at the New Orleans Charity Hospital. As noted the violence among these victims is predominantly homicidal.

TABLE II.—CAUSES OF DEATH AMONG THE 478 CASES OF PENETRATING ABDOMINAL GUNSHOT WOUNDS RECENTLY STUDIED AT THE NEW ORLEANS CHARITY HOSPITAL. THE ANALYSIS SHOWS THE CAUSES OF DEATH IN RELATIONSHIP TO THE TYPE OF HEMORRHAGE AMONG THESE FATAL CASES

Cases	Shock	Hemorrhage		Under-estimated
		Medicinal	Mistake	
Hemorrhage and shock		7	141	
General peritonitis and septicemia	13		49	
Cystitis and pyelonephritis				
Pneumonia		10		
Septicemia and exanthema	3			
One pyogenic abdominal wall				
Spinal cord injury				
Subphrenic abscess				
Liver abscess, traumatic				
Cervical thrombosis				
Cecum, transverse colon				
Mesenteric abscess				
Cecum, urinary bladder				
Extraparietal abscess				
Cecum, lung (left)				

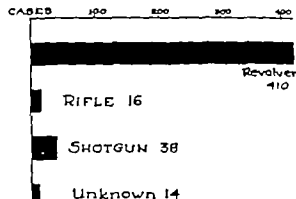


Fig. 2. Type of weapon. The revolver and automatic were by far the weapons of choice by the assailants among the 478 victims of penetrating abdominal gunshot wounds recently studied at the New Orleans Charity Hospital.

as part of the surgical treatment of war casualties, and that is the collection, proper storage and dispatch of blood donated by the civilian population for use in the combat areas. The Republican Army Medical Corps used "small medical units in the field" as transfusion teams, whereas in Franco's armies the transfusions were usually given at fully equipped medical centers in the rear. The newly introduced sulfonamides were first used in 1937 (104) in some cases of seriously infected war wounds. Jolly mentions nothing about the use of the sulfonamides in cases of abdominal wounds.

Jolly states that to-day there can be no excuse for conservative treatment of abdominal gunshot injuries. Surgical intervention is therefore advised in all cases except (1) the ones in which general peritonitis is well advanced, (2) those failing to show evidence of hollow viscus perforation and in which there is not enough blood loss to endanger life (3) moribund cases, and (4) those cases in which there are additional wounds that are obviously incompatible with life. He says further that a "blood transfusion should be started just before operation" in these cases. Ether is considered the anesthetic of choice "when gas and oxygen are not available."

In his discussion of the operative treatment of this type of case Jolly emphasizes the importance of systematic exploration. He cautions that unless this is done "lesions will be missed." It is advised that if the lesion is predominantly hemorrhagic the bleeding point or points should be found as soon as possible, and "the liver, spleen, mesentery and posterior abdominal wall should be examined in that order." When the injury or injuries are predominantly perforations of the hol-

# LORIA PENETRATING WOUNDS OF THE ABDOMEN

viscera each lesion should be marked with a table (Poirer) forceps and the search continued other lesions. After one is satisfied that no other injuries are present repair is done in a systematic fashion. By following this plan valuable time is saved.

Of interest in this connection is Jolly's recommendation that resection of the colon should be done in those cases of large bowel injury showing 'larger tears and retroperitoneal wounds' of the fixed portion of the colon. This should be done he says, 'notwithstanding the appalling mortality rate.'

The treatment of injuries to the rectum depends upon whether the wounds are extraperitoneal or intraperitoneal. The latter are the most serious and are usually attended by a higher mortality rate. The former are managed by primary removal of the coccyx and sometimes, too, of a portion of the sacrum. However it is further advised that if such an extensive operation is done for repair of injuries to the rectum it will be unsatisfactory unless a colostomy is performed at the same time.

Liver wounds, which varied in type and severity were treated according to the exigencies of the case. When it was believed certain that there was no injury to the hollow viscera they were treated conservatively. However if injury to a hollow viscus could not be excluded or if there was any doubt at all regarding this matter celiotomy was considered to be mandatory. Large liver lacerations were packed. Smaller fissure wounds were sutured with deep mattress sutures of catgut, a fringe of the omentum being introduced into the lips of the crater before tying.

Unless wounds of the spleen were very trivial and not bleeding removal was considered the procedure of choice. Jolly is of the opinion that wounds of the pancreas are 'nearly always fatal. It is his further opinion that these lesions are seldom seen or seldom found. Except for drainage used in cases of injury to the pancreas, drainage of the abdominal cavity should be abandoned for gunshot wounds of the abdomen.

In the discussion of the postoperative care of cases of abdominal gunshot injuries Jolly emphasized the importance of morphine the giving of small quantities of fluids by mouth and the establishment and maintenance of a proper fluid balance. In this regard it is his feeling that had it been possible to use the "Abbot jejunointestinal tube for decompression of these cases during the Spanish Civil War more lives might have been saved. Although Jolly gives an incidence of 11 per cent in abdominothoracic wounds his series does not

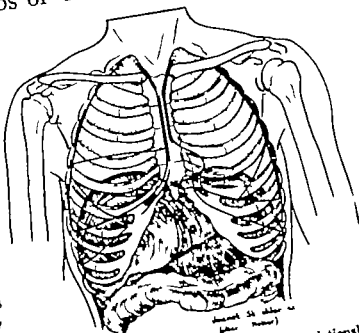


Fig. 13. Diagrammatic sketch showing the relationship of adjacent abdominothoracic structures, and why penetrating wounds of the abdomen or chest at proper levels frequently involve both cavities.

include casualties in which bullet wounds obviously affected the abdominal cavity but in which because only the liver was affected and hemorrhage did not threaten life, operation was not called for. Inclusion of these cases would have undoubtedly increased the incidence of this special type of case. The management of this type of wound introduced special problems and the choice of abdominal, thoracic or combined abdominothoracic approach for the operation in these cases depended upon the special problems presented.

## EXPERIENCES DURING WORLD WAR II

The usual general interest in the surgery of abdominal trauma is always considerably intensified during wartime. Hence the appearance in the literature of more than 359 articles on abdominal gunshot injuries—only one of the many types of injuries involving this cavity—from January 1940 to June 1946 inclusive is not by any means unexpected. Although some of these contributions have come from civilian sources an increasing number represents the studies, personal experiences and observations of a large number of surgeons serving in the Armed Forces during the recent second World War.

The various phases and aspects of the abdominal injuries of warfare including their complications, were rather thoroughly considered at the start of the second World War by (1) the Committee on Surgery of the Division of Medical

Sciences of the National Research Council, whose contribution on Abdominal Injuries was prepared by Storck (102) by (2) Davis, Heyd, Gordon Taylor (38), and Fulton, and by (3) Fraser (33) (34) (35) Charles Gordon-Taylor (39) Gordon Watson and Morgan, and McFadden and Galloway. The first of these contributions represents the official manual of the United States Armed Forces on the management of abdominal wounds. The second group, nearly all by Americans, comprises outstanding authorities on the subjects discussed, whose individual contributions are grouped in one volume entitled "War Medicine." The third is by a group of British authorities whose respective contributions appear in the "Surgery of Modern Warfare" edited by Hamilton Bailey. As the War progressed these contributions were supplemented by bulletins on abdominal injuries issued by the War Offices of America and Britain from time to time. Because of its interesting aspects, one such bulletin is quoted in full at the end of this section.

Most writers on this subject have a distinct appreciation of the lethal character of abdominal gunshot wounds. However the frightful realities of penetrating abdominal wounds, especially as they apply to modern total warfare, have never been sufficiently emphasized to make us appreciate the true and full significance of this type of injury. Goetze (1929) is quoted by Baron as saying that theoretically we may say that under optimum conditions of surgical technique and transportation in warfare, it is possible to save from 25 to 30 per cent of the patients with penetrating wounds of the abdomen who would be doomed to certain death without operation. In his analysis of this problem, Baron continues by saying that when we face the cruel realities of World War I, as they apply to our (Spanish) experiences, we see that while it is true that from 1,850 to 3,700 abdominally stricken soldiers owe their lives to timely surgery by celiotomy we also realize the relative insignificance of our contribution when we find that the deaths of 10 per cent of the 1185,000 soldiers killed outright on the battle fields of World War I were caused by the shock and hemorrhage of penetrating abdominal wounds! On the strength of this statement, therefore, 118,500 soldiers, victims of penetrating abdominal gunshot wounds on the fields of battle during the first World War died before any surgical help could possibly reach them. This is indeed a very gloomy and challenging revelation. However the encouraging reports that have come in from the recent (second) World War make it appear that the improved transportation facilities

and the improved methods of management generally have cut the mortality figures down rather appreciably.

Most observers during the recent World War II seem to agree that the splendid improvement in the mortality rate (23 47 93 80 100) of abdominal gunshot injuries is largely explained by three factors: (1) the free availability of large quantities of plasma and blood for resuscitation and the treatment of shock (10, 25, 47 93) (2) the judicious use of chemotherapeutic agents—the sulfa drugs at first and later the antibiotic penicillin (4 46, 65) and (3) improved surgical methods and techniques. To these one should undoubtedly add the improved facilities for the preoperative and postoperative treatment in these cases, many of which were already in civilian use before the War. Hence the improved method of gastrointestinal drainage, the availability of the Miller Abbott tube, a better understanding of the importance of a proper fluid and electrolyte balance, and other advances and improvements in the management of the surgical patient, practically none of which were available to the surgeon in the first World War undoubtedly had much to do with the great decrease in the mortality rate among the abdominally injured in World War II. In addition, the presence of many well trained and qualified anesthetists to supervise the administration of anesthetics to these patients at all hospitals, unquestionably also had much to do with the increased recovery rates reported (23 47 80 85, 93, 100).

Another factor of great importance in cutting down the mortality rate from the previous usually high figures was the great care taken by the surgeon in attempting to establish a more precise preoperative diagnosis in these cases (75). At no time in the past has this type of injury been so diligently and thoroughly studied as during the recently ended conflict. Every conceivable factor and possibility were given the greatest consideration in an effort to reduce the mortality rate among the victims of abdominal injuries. As a result, such problems as abdominothoracic gunshot injuries, air blast injuries, water blast injuries, and injuries to the extraperitoneal structures—especially the kidneys and extraperitoneal portion of the rectum—were understood better and treated with more success than at any previous time.

Because two very important cavities are involved in abdominothoracic gunshot wounds, there is always doubt as to the seriousness of the abdominal or thoracic injuries. Even after careful study and consideration the surgeon is often in doubt as to whether he should open the chest,

the abdomen, or both. The special difficulties usually encountered in this kind of injury are well discussed by Gordon-Taylor and others (38, 48, 61). Studies by these writers give the impression that the mortality rate among such cases is greater than among the cases in which the abdomen alone is involved. In general the mortality rate among victims of abdominothoracic gunshot wounds depends upon the organs or structures damaged, the extent of the injuries, and the condition of the victim when injured.

#### BLAST INJURIES

During the first World War one of the most frequently observed disturbances, occurring especially in areas of artillery action, became known as shell shock or shell concussion. The victims of such injuries were often found unconscious, or at times in a semiconscious condition, and yet showed no evidence of any actual external injury. Not infrequently the victims of such injuries were found dead. Autopsies showed evidence of numerous petechial hemorrhages in the brain. In addition Mott also showed that many of these patients were actually the victims of carbon monoxide poisoning and it was further shown (36) that many of the deaths from blast really resulted from carbon monoxide poisoning of victims who were rendered unconscious and who were trapped under fallen debris. It is now believed by some that many of the shell shock and shell concussion cases of the first World War were possibly cases of what we now know as blast injuries.

In the War just ended blast injuries attracted considerable attention and were the subject of many studies and reports (7, 39, 110, 111) made especially by the British. As one surveys the literature on this type of injury he is impressed with the fact that air blast victims suffer injuries predominantly to the structures within the thoracic cavity especially the lungs (5). On the other hand, "underwater" or "immersion blast" injuries result in damage affecting principally the intraperitoneal structures. Solid blast injuries (7) usually result in fractures involving the lower extremities, the hips, pelvis, or spine. Thus far the writer has been unable to locate any reference to solid blast injuries which caused damage to intra-abdominal or intrathoracic structures. On the other hand air blast injuries although predominantly involving the intrathoracic structures, may likewise be complicated by some intra-abdominal damage, and "immersion blast" injuries, although mainly involving the intra-abdominal structures, may also result in trauma to the lungs. It is very likely too, that all types of blast injury

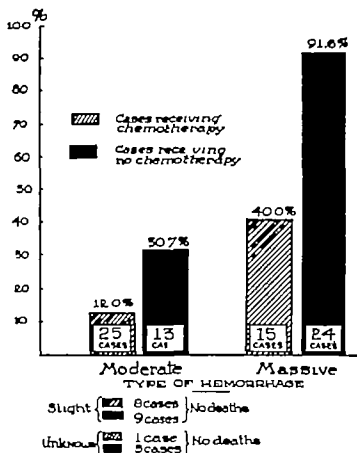


Fig. 14. Graph showing relationship of hemorrhage to mortality rate in a comparative study of 100 cases admitted to the New Orleans Charity Hospital from July 9, 1938 to July 9, 1943. The influence of chemotherapy on 49 patients is compared with a group of 51 cases receiving no chemotherapy during this same period of time.

victims also have an involvement of the central nervous system to a lesser or greater extent.

It is the opinion of Rose and Watson (94) that the prognosis of an abdominal injury whether subcutaneous or penetrating is rendered graver when the injury is accompanied or complicated by blast effects. The pathologic findings in blast injuries which predominantly involve the chest are pulmonary hemorrhages of varying degrees, contusions, and possible lacerations of other intrathoracic structures. Blast injuries which predominantly involve the abdomen result in submucosal, subserous, or intramuscular hemorrhagic areas that may be found in any part of the gastrointestinal tract but more especially the lower ileum and large bowel. Such hematomas may also be seen in the great omentum and mesentery as well as in the retroperitoneal tissues and the solid viscera. When perforations or lacerations occur, they are more likely to involve the small intestine. Hence, although death from uncomplicated primary blast was rather rare, some of these patients were injured sufficiently seriously to succumb.

The signs and symptoms of blast injuries of the abdomen are essentially those seen in any acute abdominal catastrophe. Severe abdominal pain is frequently accompanied by nausea and vomiting. There is usually generalized rigidity and tenderness. An absence of peristaltic waves should make one very suspicious of intestinal perforation. This may be confirmed by the finding of free air in the peritoneal cavity on x-ray examination. Unless there was very serious damage such as intestinal perforation or laceration of a solid viscus, almost all of these cases showed evidence of improvement after several hours, following which the signs of serious or grave danger disappeared more rapidly.

All patients with blast injuries were treated with the usual resuscitative measures. Plasma and blood were given freely. Every effort was made to restore the victim's normal fluid and electrolyte balance. It was indeed seldom that any patient with a blast injury involving the chest required operation. Some of those with abdominal blast injuries, especially those showing evidence of intestinal perforation or severe internal hemorrhage, had to be celiotomized, and, frequently the victim's life was saved.

#### INJURIES TO THE EXTRAPERITONEAL STRUCTURES

In general, the question of preoperative diagnosis in abdominal injuries, and especially those involving the extraperitoneal portion of the rectum and other extraperitoneal structures, has previously been given too little attention. Mainly because of this lackadaisical attitude usually on the part of those handling these cases, many victims of traumatic abdominal catastrophes who might have been saved have died. The mortality rates in the past have been extremely high. Not infrequently the surgeon because he believed the missile could not have passed through a given area, or because he felt that a given crush injury could not have involved a given structure, has failed to repair damage that ultimately meant death to the victim. Failure to examine the urine preoperatively or to examine the rectum digitally or proctoscopically has on occasions caused the attending surgeon much embarrassment postoperatively.

The lessons learned in the past along these lines were very useful in the recently ended second World War and, undoubtedly, led to the saving of many additional lives. The percentage of overlooked serious injuries to abdominal structures was probably less during the recently ended conflict than heretofore. Badly damaged kidneys were removed and the loss of blood from this source stopped in time to save the life of many such vic-

tims. Catheterization often revealed injury to the kidney, ureter bladder or urethra which might otherwise have been overlooked. Digital and proctoscopic examinations of the rectum often surprised the examiner with evidence of injury to this structure. Hence, the greater care exercised in making a more accurate preoperative diagnosis in these cases of injury to the extraperitoneal portion of the rectum and other extraperitoneal structures, undoubtedly had much to do with the lowered mortality rates reported by many writers (18, 39, 41, 54, 55). The adage to be forewarned is to be forearmed is just as important to the surgeon in dealing with abdominal catastrophes as it is to anyone else in any other field.

Injuries involving the abdomen—especially the lower half—the buttocks, sacrum, or hips, or any gunshot injuries of the posterior aspect of the thigh which seem to have an upward course, particularly when there is no exit point, should invariably call for at least a digital examination of the rectum. If considered necessary a proctoscopic examination very carefully done, should also be made. According to Laufman, the patient with a penetration of the extraperitoneal portion of the rectum may present no symptoms referable to this organ at the time of initial examination. Although only 6 per cent (55) of all buttock wounds involve the rectum it is well to keep Laufman's warning in mind that "missiles entering the body anywhere between the levels of the lower thigh and the costal margin have been known to penetrate the rectum."

The operative treatment of wounds involving the extraperitoneal portion of the rectum is divided into two phases (1) the management of the rectal injury and (2) the construction of a temporary occlusive colostomy. "It is considered best to do the perineal or posterior portion of the operation first. Adequate drainage of the perirectal region is of great importance. Laufman believes that it is not necessary to remove the coccyx to secure good drainage of the perirectal space. In addition to proper and adequate drainage of the perirectal space, a thorough debridement of the area involved should always be done, and any large defect in the rectal wall should be properly repaired.

#### UNUSUAL INJURIES INVOLVING THE PERITONEAL CAVITY

The most unusual kinds of accidents have been known to result in injuries involving the peritoneal cavity as well as other cavities. Among the most interesting of these are impalements and other accidents of a similar nature.

Although impalement is not considered as a diagnosis in the last (1946) edition of the 'Standard Nomenclature of Disease and Standard Nomenclature of Operations' published by the American Medical Association, this unusual and frequently bizarre, ghastly, and gruesome condition is so different from the usually pictured penetrating and perforating wound of the peritoneal cavity that it appears more proper to discuss it under this heading. Certainly such accidents give rise to unusual and very often freakish injuries involving the body cavities. Historically no other type of wound is as interesting as impaling injuries.

According to Pennington, the Oriental races have always been noted for their ability to devise fiendish forms of punishment, and one of their devices was impalement. This was carried out in two ways—the victim was laid down and the stake driven into the body or else it was planted in the earth and the culprit fastened to it so his weight caused the body to become impaled. This form of punishment dates back to the hoary past.

"In ancient Rome impalement was at first restricted to slaves who had been guilty of robbery. Later on Nero resorted to it among other measures in his persecutions of the Christians. Soon after the irruption of the Ottoman Turks into Europe they made use of it for various offenses. Those guilty of business transactions between Mohammedans and Christians, treason, fraud against the Sultan, etc. In Russia Germany and Austria, it was generally prevalent up to a comparatively recent period in cases of murder and witchcraft. For adulterers caught *in flagrante delicto* according to Silberman double impalement was in vogue. We learn from Fairlie, that in the Malay Peninsula, a unique method is in use for female marital infidelity. Some species of bamboo grow there with extraordinary rapidity and the one selected increases in length 24 inches in 24 hours. A young shoot just sprouting from the ground is selected, and the end whittled to a sharp point the condemned woman being lashed to stakes over the bamboo is impaled in two days.

During the hand-to-hand combats of the Middle Ages, when the body was largely protected by plate-and-mail armor, the rectum probably escaped injury. Though this immunity disappeared with the introduction of gunpowder. However, the feeble penetrating power of the old round—and even the conical bullet later had little effect on the lower bowel in its bony encasement. With the advent of the modern small bore projectile of enormous velocity which respects nothing in its course, rectal wounds, have become relatively numerous.

'One of the English kings, Edward II, was murdered (A.D. 1327) by having a red hot iron thrust up the rectum and it is rumored this was one of the many arguments adopted by the Inquisition to admonish heretics. At the time (17th and 18th centuries) when clysters were a panacea for every imaginable ill, and they were administered by the ignorant nurses of the day or even laymen, e.g. druggists, apprentices, serious and fatal injuries from the syringe points were somewhat frequent. This was before the days of rubber when metallic instruments alone were available in fact, such mishaps have been recorded well into the last century.

Today although impaling wounds are relatively rare, they nevertheless rather frequently involve the peritoneal cavity and are of sufficient importance to be included in any discussion which considers trauma to the perineum in general and to the vagina, anus, and rectum in particular. It is of interest to note, according to Black (11) that seven cases of rectal impalement with damage to intraperitoneal viscera were encountered at the (Mayo) Clinic from 1910 to January 1 1939. From January 1 1896 to January 1 1948 the Charity Hospital of Louisiana at New Orleans admitted 12 cases of impalement wounds which involved the abdomen. Five of the patients were negro males. Among the 7 white patients 2 were females.

Almost every perineal and pelvic structure, and many abdominal and thoracic structures have been injured (66 87) as a result of impalement. Although the literature on this subject is small interesting individual cases, as well as collected groups of such cases, have been reported from time to time. Impalement injuries are very rare in warfare. They are almost entirely a civilian type of injury relatively more commonly seen in agricultural districts. Severe and serious injuries to the urethra, vagina, urinary bladder, prostate gland, seminal vesicles, and ureters are not infrequent, and injury to almost any portion of the gastrointestinal tract is not impossible. Usually because of the manner of entrance of the impaling object, as well as the position of the large vessels, injury to the latter is relatively rare. Most of the fatalities in this kind of case result from generalized peritonitis. Relatively few victims die of hemorrhage and shock.

Most impaled injuries result from falling in such a way that the body strikes the object usually a stake or picket, with a considerable force. Possibly no other field in traumatic surgery can claim any more unusual and bizarre kinds of accidents than this one. In many instances, perversions have been responsible for the introduction



of rather large, gruesome, and ghastly foreign bodies into the vagina and rectum. The introduction of rather stiff rectal rubber tubes have been known to result in perforations of the recto-sigmoid. Proctoscopic examinations (95) and enemas (81) have also resulted in serious injury to the bowel.

Involvement of the peritoneal cavity is often very difficult to determine. Frequently, the victim removes the foreign body and walks a long distance to his home. However the onset of severe lower abdominal pain followed often by collapse should remove all doubt as regards the advisability of emergency celiotomy. Digital examination of the rectum, although indicated, will frequently give very little information. Proctoscopic examination is usually mandatory and the finding of air under the diaphragm is practically positive evidence of intestinal perforation. Bloody urine is almost invariably conclusive proof of serious injury to the urethra, bladder or ureters. Nausea, vomiting, a rapid pulse, and fever are signs which develop somewhat later. In the transportation of these patients, the sitting or semi sitting position is considered best and advisable.

Synopses of 4 of the 12 cases of impalement received at the New Orleans Charity Hospital are being given because of their unusual and interesting aspects.

**CASE 1.** A white male, a fireman 34 years of age, who on December 5, 1913 was struck in the buttocks and in the perineum by a forceful stream of water from a fire hose. Upon admission to the hospital, his scrotum was found to be markedly swollen and painful. A 6 inch laceration exposed the muscles on the inner aspect of his right thigh. The perineum was lacerated in a stellate manner and the sphincter was torn in its posterior area. The laceration ran up the posterior aspect of the rectum for 3 or 4 inches. Treatment consisted of packing and daily irrigations. The patient left the hospital on March 22, 1914.

**CASE 2.** A white male saw-miller, a laborer of 56 years. While at his work on December 9, 1914, stick flew off of the saw and entered the lower left abdominal quadrant making its exit in the right gluteal region. At operation, the stick was found to have struck the iliac crest in such a way that it split and one portion passed through the gluteal muscles to the right. The other portion, nearly 1 inch in diameter and 3 inches long, directed the left iliopectineus muscle as high as the kidney. Multiple lacerations were found in the ileum and feet had to be resected. Other pieces of splinter were removed. The patient died of generalized peritonitis on December 27, 1914.

**CASE 3.** A male negro, 68 years of age, who was admitted on April 21, 1910. While riding a horse, the patient fell off and landed on a picket which penetrated the right side of his abdomen. In the operating room, pieces of clothing were removed from the abdominal wound. When the abdomen was opened, piece of wood 12 inches long, 3/4 inches wide, and 1/2 inch thick was found to be wrapped up with omentum. A 3/4 inch "transverse rent" in the descending colon was repaired. The stick was freed from the omentum with difficulty and was only "pulled" from the

wound "after a mighty heave." The patient expired the next day.

**CASE 4.** A white female, 28 years of age. She was admitted to the hospital on January 19, 1915 with the complaint of "bottle in rectum." The patient said that a friend introduced a coca cola bottle in her rectum while she was intoxicated. Examination showed the base of coca cola bottle 3 1/2 inches above the rectal sphincter.

Under spinal anesthesia, the bottle was extracted with large clamp with some difficulty. No perforation was observed. Twelve hours later the patient presented evidence of generalized peritonitis. An emergency operation was performed and generalized peritonitis, more pronounced in the pelvis, was found. No attempt to find the site of perforation was made. About 500 c.c. of purulent material were aspirated from the pelvis. Mucicic colostomy of the sigmoid was done, and the patient returned to the ward in fair condition. She left the hospital on February 21, 1915 and on September 18, 1915 the colostomy was closed.

Of unusual interest, also, are 2 cases of such injuries treated by two colleagues, Drs. H. H. Russell and D. J. Murphy at the Hotel Dieu Hospital of New Orleans.

**CASE 5.** A white female, 57 years of age was first seen on August 23, 1913 with the complaint of severe lower abdominal pains, fever, nausea, and vomiting. The history revealed that 3 or 4 days previously a rectal examination was done elsewhere with a proctoscope. On August 24 a vaginal diagnostic aspiration of the cul-de-sac showed the presence of a foul smelling fluid with a *Bacillus coli* odor. On September 4, 1913, posterior colpotomy allowed the escape of about 400 c.c. of foul smelling sanguinopurulent material. The patient was discharged from the hospital on September 9, 1913 after a very stormy postoperative state.

**CASE 6.** A white male, 48 years of age, was admitted on January 3, 1916 with the complaint of severe abdominal pain. A few hours before, this patient, because he had been constipated, took an enema by attaching the rubber tubing of an enema bag to the faucet of his bath tub. He inserted the nozzle into his rectum and turned on the water. After "a brief period," he was seized with sudden violent abdominal pain and collapsed on the floor. Upon reaching the hospital in an ambulance he was more comfortable and refused operation. However on January 8 days after admission, he consented to an operation. This was done under spinal anesthesia and large amount of fluid feces was found in the peritoneal cavity and removed. In the terminal ileum, there was found "rent" about 2 1/2 inches long. About 3 feet of ileum were resected. The patient died about 4 hours later.

Autopsy showed, among the usual other findings, "traumatic rupture of the rectum and ileum" and generalized peritonitis.

#### ANESTHESIA IN THE SURGERY OF ABDOMINAL TRAUMA

It is doubtful that any sufficiently effective anesthetic agent was ever used in the management of abdominal injuries before 1846. It is very likely too that patients with abdominal trauma were among those subjected to operation, under the influence of ether or chloroform, during the period of greatest controversy regarding anesthesia in this country between 1846 and 1863. Spinal an-

esthesia introduced in 1885 by Corning (56) was probably not used in the operative treatment of these patients until after the beginning of the present century.

The story of the development of anesthesia so interestingly told by Keys and so excellently and thoroughly outlined by Leake plays a most important role in the management of all types of wounds of the abdomen and chest. To the surgeon who has been given the responsibility of treating a seriously wounded abdomen there is nothing as important during the period of operation as a well relaxed and calm abdomen. It is only an abdomen in this condition that will permit of the most thorough exploration with the least added trauma and in the shortest period of time. Nothing will handicap the surgeon's work in these cases more than a poorly administered anesthetic and nothing will help the causes of thoroughness and expeditiousness more than a good relaxing anesthetic.

Plain drop ether was for many years the anesthetic of choice in the operative treatment of the injured abdomen especially at the New Orleans Charity Hospital. Gillies and Evans say that in surgery for abdominal trauma, inhalational anesthesia with nitrous oxide and oxygen, supplemented by local infiltration or intercostal nerve block is the method of choice, especially in the presence of shock. Alternatively cyclopropane and oxygen may be used, and in cases exhibiting little or no shock gas, oxygen and ether may be required because the threshold of the patient's resistance to anesthesia has remained at its normal level. Turnbow is of the opinion that "in general combinations of anesthetic agents are safer for seriously injured patients." He considers spinal anesthesia to be unsafe and was used infrequently. In the majority of his cases, Eaton induced anesthesia with ethyl chloride or pentothal then switching over to warm ether from the Oxford vaporizer. In general, most of the surgeons reporting their experiences during the recent World War (II) preferred ether as the anesthetic of choice. Induction was usually accomplished with nitrous oxide or pentothal sodium given intravenously.

Almost from the time it was introduced spinal anesthesia has been considered very dangerous in this type of patient, and the chief reason given is that it adds to the shock of these usually already shocked patients whose general preoperative condition is frequently very poor. Nearly all reports from the recently ended War condemn spinal anesthesia as being unsafe and dangerous in these

TABLE III — TYPES OF ANESTHESIA USED IN 366 CASES OF PENETRATING ABDOMINAL GUNSHOT WOUNDS OPERATED UPON AT THE NEW ORLEANS CHARITY HOSPITAL BETWEEN JANUARY 1 1927 AND JANUARY 1 1942 IT IS INTERESTING TO NOTE THAT THE GROUP OPERATED UPON UNDER SPINAL ANESTHESIA SHOWED THE LOWEST MORTALITY RATE AMONG THE THREE LARGE GROUPS

Anesthesia	Total	Lived	Died	Mortality Per Cent
Ether				
Ethylene	10	83	108	56.54
Nitrous oxide and ether	0	6	3	33.33
Cyclopropane	7	8	3	71.43
Local	5	4	1	20.00
Spinal	7	3	4	57.14
Ether and ethylene	74	51	23	31.08
Spinal and ether	35	23	12	62.85
Epidural	3		3	60.00
Epidural, ether and ethylene	3	0	3	100.00
Epidural and ethylene			1	100.00
Cyclopropane and ether		0		00.00
General	16	13	3	18.75
Cyclopropane, the and ethylene	4	3	1	50.00
Ethylene and cyclopropane	2	1	1	100.00
Not given	4		8	50.00

cases. However none of these reports include any appreciable number of cases in which spinal anesthesia was used. On the other hand Davis has found spinal anesthesia the most suitable not withstanding the presence of severe shock and hemorrhage. In a relatively recent study of 478 cases of penetrating gunshot wounds of the abdomen the writer (62) found that a group of 74 patients operated upon under spinal anesthesia showed the lowest mortality among the large groups. The present general impression is, also that intravenous anesthesia is not especially suitable for cases of abdominal trauma unless oxygen and curare are used with it.

#### WAR BULLETIN ON ABDOMINAL WOUNDS

Of special interest during the recently ended World War were the bulletins on the management of different types of wounds issued by the various War Offices. One such bulletin, which reviews the general management of abdominal wounds in the light of relatively recent war experiences, and

which was issued by the British War Office, has been considered sufficiently interesting and important to be quoted in full in this presentation.

This article (4) should be regarded as an extension to chapter 20 of the Field Surgery Pocket Book. (1) What was written there in 1943 has stood up well to later experience in the field, but fresh campaigns have taught new lessons and re-emphasised the importance of old teachings—above all on the importance of postoperative care.

#### *"When to operate"*

Everyone agrees that men with abdominal wounds need operation as early as possible if they are to have the best chance. But too literal an interpretation of this phrase as early as possible may result in men being operated on in areas so far forward that bad conditions more than counter-balance the benefits of a few hours gained. It cannot be emphasised too strongly that men with belly wounds do badly in noisy surroundings; peace of mind is one of their great needs, and sick men cannot always differentiate the noise of our own guns from that of enemy bombs and shells. Sometimes in isolated places there was no alternative to operation on the spot—as on the Anzio beach-head—but the patients were in a constant state of alarm and never got really restful sleep. Some even jumped out of bed and crawled under it for protection, and many Field Medical Cards noted that the medical services were forced to evacuate this man because of his mental state. Under such unfavourable circumstances, heroic doses of luminal are justified. Grains 5 may be given twice daily and continued with safety for several days; this treatment does not paralyse bowel action, which is a serious objection to repeated doses of morphine.

In practice there are very few belly cases that cannot be sent off at once or after an hour's resuscitation. With a travelling transfusion (2) (in ambulance drip) where necessary they will travel safely and with great subsequent advantage, to a surgical centre some two hours down the road, where quiet and the best nursing can be given. It is of particular importance to the success of a travelling transfusion that the needle should be inserted far enough into the vein otherwise plasma leaks into the subcutaneous tissue. Apart from any other consequences, this completely spoils the area for further transfusion. Almost the only type of abdominal wound in which half-an-hour makes all the difference between life and death is that where haemorrhage is the predominant feature. These cases can be diagnosed by the presence of ab-

dominal rigidity, pallor, rapid pulse, and low blood pressure—signs that are established in about 2-3 hours after wounding. Therefore, unless the position is an isolated one or there is evidence of haemorrhage, all men with belly wounds should be sent to an Advanced Surgical Centre to have treatment in its safety and relative quiet.

#### *Diagnosis*

Position when wounded. It is important to try to learn from the patient what position he was in when he was wounded—was he standing, running, kneeling, crawling, prone, or what? The answer is of great help in working out the lesions that are to be expected.

Peristaltic sounds. The presence or absence of peristaltic sounds has considerable significance, though there is no absolute rule. When sounds are present there is not likely to be any perforation of a hollow viscus, though intestinal rumblings may be heard when there is a small hole in the pelvic or sigmoid colon. Absence of sounds is very suggestive of perforation of hollow viscera, but auscultation should be repeated at intervals, especially if there is no rigidity and if other signs—such as those of haemorrhage—are absent. A blow in the stomach or exposure to blast, may cause peristalsis to cease for an hour or so, after which it starts again.

#### *Resuscitation*

"As with all wounded, the sooner the man with wounds of the belly is got to an Advanced Surgical Centre the better, and it is important to persuade R.M.O.s. and M.O.s. of Field Ambulances not to spend too much time on resuscitation. (3) Not all abdominal cases require intravenous fluids, and when these are thought necessary it is best to give plasma unless there are signs of haemorrhage. Too much blood may precipitate anaemia in abdominal cases. At R.A.P. or A.D.S. level, it is better to give one or two pints only and then send the man without further delay to the Surgical Centre with a travelling transfusion in the ambulance. If signs of intra-abdominal haemorrhage are present, blood should be given in the same way but in these circumstances it is even more important to get the patient to the surgeon as soon as possible.

#### *Operation*

"General. There is much to be said in favour of the midline incision. If a paramedian skin incision is used, the whole rectus muscle should be reflected laterally because the more usual practice of splitting the rectus may deprive the inner part of the muscle of its blood and nerve supply. Un-

hurred speed is essential for with every five minutes beyond the hour there is a worsening of the patient's condition. It is important to make the incision long enough, and to avoid pulling on the parietes with retractors; this always leads to a fall of blood pressure.

**Anaesthetic.** A number of surgeons and anaesthetists are now using intercostal block anaesthesia combined with light intratracheal gas, oxygen, and ether. All agree that this gives perfect relaxation and that post-operative chest complications are less common than with other anaesthetics.

**'Colostomy.** Every endeavour should be made to fashion a double-barrelled spur. When stitching the parallel limbs together it is a good thing to rotate the loop in its long axis somewhat, so that the contiguous surfaces are well away from the mesenteric border; this obviates the risk of damage to the blood supply by the subsequent application of the enterotome.

**'Large Intestine Wounds.** Many experienced surgeons are moving away from the principle that a damaged colon must always be exteriorised. They feel that in the right half of the colon small perforations with clean-cut margins and no surrounding bruising can be safely dealt with by careful suture. A number of small perforations of the anterior wall of the rectum have been similarly treated. It is essential for safety however that a small drainage tube should be put down to the site of suture and left in position for three to four days and it is wise to cover the suture line with omentum if this is practicable. A variation is to anchor the sutured colon to the parietal peritoneum with a few stitches.

'Opinion has shifted thus from the more orthodox view because many surgeons felt that the amount of mobilisation which was sometimes necessary carried with it a risk of shock that was a greater danger to the patient than the possibility of an intra-abdominal abscess. They also knew from hard experience that colostomies performed hurriedly in a patient ill from multiple wounds are not always easy to close at a later date and of course, a colostomy is not a pleasant thing for the patient.

'The results have been satisfactory in the hands of surgeons who have long experience and are skilled in their selection of cases the less mature who are in any doubt should always be exteriorised. It is worth repeating—

(1) suture should be employed only if the hole is small and there is no surrounding bruising of the adjacent bowel wall (2) a drainage tube should be employed.

### Postoperative care

The first 24 hours after operation should be regarded as a second phase of shock initiated by a second trauma—the operation—and the same careful observations on blood pressure should be made as in the resuscitation ward. All cases return from the theatre on intravenous fluids; serial blood pressure readings should help to fix the decision on the continued use of blood, plasma or glucose-saline and on the rate of the drip.

**Gastric suction.** Every belly case is put on continuous gastric suction; this and intravenous therapy are usually maintained for about three days, until there is no distention and until peristalsis is active. From the second day onwards it is wise to give fluids by mouth clipping the suction tube for about an hour afterwards. These drinks can be started at the rate of 1 ounce 2 hourly for 12 hours then they can be increased to 2 and later to 3 ounces. It has been found in many cases that about one third of the fluid taken by mouth passes the pylorus and is absorbed. This in itself is valuable and has a great effect on the morale of the patient. It is a good thing also to include in these drinks nutrients such as glucose, tinned milk, Benger's food, thin soups, and ice-cream. Aminoacids in their present preparations are too unpalatable for administration in this way but if this difficulty is overcome they will be of great value.

In the early days after operation it is most important to keep careful fluid charts that show intake by vein and mouth and output by urine and suction. Daily intake should be 4.5 pints in cool climates and 7-8 pints in hot weather.

To help overcome the lack of protein in this regime, one or two bottles of plasma (or serum which contains about twice as much protein as plasma) should be given daily. The Shock Research Team (3) has recently drawn attention to the serious deficiency in chlorides that develops early during this regime. On this point, the following remarks kindly offered by Dr R. A. McCance are helpful. A rough way of meeting the salt requirements of the body is to give 2 pints of every pint of normal saline daily, plus one pint for every pint of gastric contents withdrawn by suction, but more saline (up to 4 pints) may be needed in tropical climates or if the urine does not contain chlorides. The remainder of the fluids given should be 5 per cent glucose or other non-saline fluids. About the 7th-8th day after operation, blood should be given if necessary to keep the haemoglobin level up to 60-70 per cent at the very least.

In quiet times each surgeon will probably wish to apply his own particular ideas about post-operative treatment, but when things are busy individual differences of detail must go overboard in favour of a common routine for all in the particular centre. It is best if a senior M.O. familiar with this type of work, can be put in charge of the post-operative ward, so that he can modify the routine according to the needs of individual patients.

### *"Complications"*

"Anuria. Renal failure with anuria occurs in a proportion of all seriously wounded men, no matter whether they have been transfused with blood or with plasma or have not been transfused at all the incidence is relatively high with belly cases. The cause is not fully understood, but there can be little doubt that prolonged times anuria preceding restoration of circulatory efficiency may cause irreversible kidney damage, even though the patient's life is temporarily saved by resuscitation and operation. In belly cases additional factors may operate. Thus, there may be prolonged spasm of the renal arteries from irritation of the sympathetic ganglia by retroperitoneal haemorrhage around the coeliac plexus. Sympathetic overaction from the same cause may also explain the slowing down or cessation of intestinal peristalsis, with resulting distention this is sometimes seen in oliguric cases, and is often associated with the retroperitoneal haemorrhage of fractures of the spine.

"A badly judged resuscitation technique may readily contribute to or even precipitate renal failure. Mis-matched transfusion, with gross intravascular haemolysis, is an obvious cause. Massive transfusions of old stored blood may likewise lead to a degree of intravascular haemolysis, which is the equivalent of a mis-matched transfusion. The Shock Research Team (3) have made surgeons alive to this risk.

Another factor which may lead to renal failure is the continuous administration of those sulpho-namides, which tend to form acetylated insoluble crystals (sulphapyridine, sulphathiazole, sulphadiazine) without careful supervision of fluid intake and urinary output.

"The most rational prophylactic treatment is to restore the efficiency of the circulation at the earliest possible moment, with plasma unless fresh blood is available. With an efficient circulation, blood is only required in an amount sufficient to ensure a haemoglobin level of not less than 70 per cent at operation. The second measure is to ensure adequate hydration with a good urinary output.

"When oliguria arises and anuria threatens, treatment is not promising, but it is worth trying some of the following:

(1) Sodium citrate, grains 120 at once and grains 60 every 4 hours.

(2) 600 c.c. sodium citrate (3%) in 500 c.c. glucose (5%) as a slow drip in 24 hours.

(3) 100 c.c. of 10-50 per cent glucose given slowly by the intravenous route. (The rationale of this suggestion rests on the idea of dehydrating an oedematous organ by hypertonic solutions. For diuresis, 10-20 per cent solutions of glucose are generally used, but 50 per cent solutions can be given without ill effect.)

### *"Conservative Treatment"*

It may be possible for the surgeon to treat a case expectantly if with the help of X rays, he can make an intelligent estimate of the track and probable resting-place of the foreign body and if there are no more than minimal signs of intra-abdominal perforation. Foreign-body fragments may lodge in the liver kidney per-renal tissues, para vertebral gutters, buttocks, or perineum without having penetrated the peritoneum. In such circumstances operation should be withheld if there are no signs of peritoneal irritation. It is in such cases that the presence of peristaltic sounds fortifies the resolve to adopt conservative treatment. In a recent series of 33 patients so treated only 3 died—a much lower mortality than would have been expected if exploratory laparotomy had been performed.

### *Penicillin*

In belly cases, penicillin is still in the experimental stage. Some of the complications—pneumonia, pelvic and subphrenic abscess, peritonitis, and wound infection—are usually caused by penicillin-sensitive organisms therefore, it is rational to use penicillin, since the drug is now in abundant supply. Many surgeons think its use has been a potent factor in reducing chest complications and wound sepsis. The present dosage is 15,000 Oxford units 3 hourly for 7 days or 100,000 units in 500 c.c. of normal saline every day for 7 to 10 days by continuous intramuscular drip (4)

### *Evacuation*

Abdominal cases travel badly by sea or air even when the wound has healed. Almost all cases are now held for at least 10 days before being moved from the Advanced Surgical Centre, and this should be the routine. If the laparotomy wound goes septic, they should be held until the wound is clean.



Fig. 15 General Edward M. Packenham, commander of the British forces at the Battle of New Orleans, who died from a wound involving the common iliac artery.

#### *"Delayed suture of other wounds"*

Abdominal wounds are very often accompanied by wounds of the limbs. The patient is not really fit for a second anaesthetic about the third or fifth day which is the ideal time for the delayed suture of these wounds. One solution of this problem is to insert stitches at the first operation but to leave them untied until the wound is ready for closure.

#### REFERENCES

1. See also footnote to page 1 of A.M.D. Bulletin, supplement No. 22, May 1945 and A.M.D. Bulletin 1945 March, No. 45, article 345.
2. A.M.D. Bulletin, 1945, November No. 29, article 228.
3. Ibid., 1945, January No. 43 article 379.
4. Memo. on Penicillin Therapy in 21 Army Group February 1945."

#### NOTABLES IN AMERICAN HISTORY WHO WERE VICTIMS OF PENETRATING ABDOMINAL GUNSHOT INJURIES

Because a number of notables in American History were the victims of penetrating abdominal gunshot injuries the writer believes that a brief review of the most outstanding of these cases should not only prove interesting but likewise very important from the historical point of view. Sev-



Fig. 16 William Beaumont collecting gastric juice from the stomach of Alexis St. Martin

eral other cases involved rather important persons of the day but those have not been judged as of sufficient historical importance to merit consideration in this particular presentation.

As far as the writer has been able to determine no conspicuous person in American history has ever been the victim of assassination by stabbing and certainly none by an abdominal stab wound. Each of the individuals herein considered was the victim of an abdominal gunshot injury and true to the traditions of this type of injury all died except one. Lincoln was shot in the head, and Anton J. Cermak the late and lamented Mayor of Chicago who received the bullet intended for our late and beloved President Franklin D. Roosevelt, was shot in the right side of his chest but died of general peritonitis. Accordingly these 2 cases have been excluded from this study.

#### *General Edward M. Packenham*

The case of a 'Major King of the Fusiliers (43) who was killed at the Battle of New Orleans, is herein considered because this British officer

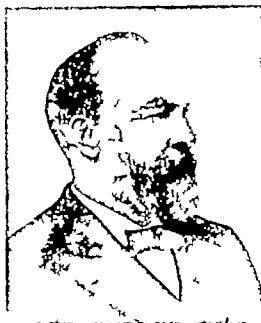


Fig. 7 President James A. Garfield.

was the victim of a musket-ball which struck him on the pit of the stomach leaving only the appearance of a contusion, apparently in the same manner as a blow from the hand of a pugilist on the same part." Of much greater interest, in this battle, is the death of Major General the Honorable Sir Edward Michael Pakenham, commander of the British forces, who received an abdominal wound involving the common iliac artery which "killed him on the spot. This casualty very probably had much to do with the ultimate outcome of this important engagement.

#### Alexis St. Martin

It took a penetrating abdominal gunshot injury, in addition to the perseverance, foresight, and good fortune of a young United States Army Surgeon, to win undying fame for Alexis St. Martin, an otherwise unknown young Canadian trapper who under less favorable circumstances would have been doomed to oblivion. When St. Martin was accidentally shot on June 6, 1822 little did he realize what an important contribution he was to make to our knowledge of the physiology of the stomach, and little did William Beaumont (82) the young Army surgeon who has himself been labeled one of humanity's great benefactors, realize that this single case was to win for him immortality in the annals of medical history.

The wound suffered by St. Martin, as the result of the accidental discharge of a musket loaded

with "duck shot," was an abdominothoracic type of injury which opened the upper left side of the abdomen and the lower left side of the chest. The whole load struck the victim from a distance of 2 or 3 feet and carried away an area of tissue larger than the size of the palm of a man's hand. Beaumont who arrived a few minutes after the accident noticed that the load had struck St. Martin tangentially tearing away parts of the fifth and sixth ribs, and leaving a large opening in the peritoneal cavity with protrusion of the lower lobe of the left lung from the thoracic cavity. The stomach was lacerated and there was much devitalization of the overlying and surrounding tissues. Because of these injuries Beaumont considered any attempt to save the victim a life as entirely useless. Accordingly, since he was unable to replace the lung properly he took out his penknife and cut away the excess. Then he applied a superficial dressing and left, expecting the victim to die in 20 minutes.

On his return, to his great astonishment and amazement, he found St. Martin still alive. After removal to more suitable quarters St. Martin was very ill for many days before he began showing evidence of recovery. Convalescence continued for many months, during all of which time Beaumont made every effort at his command to close the opening in the victim's stomach, which persisted in spite of all methods of treatment used. Since he was unable to close this opening, early in 1825 Beaumont conceived the idea of carrying out a series of experiments. However on several occasions St. Martin disappeared, usually not to return until after several months had passed. At times Beaumont became exasperated and almost frantic in trying to keep up with the movements of his patient. Finally he was able to complete his experiments and he published his work in 1833. Alexis St. Martin lived, with this permanent gastric fistula, for nearly 60 years after the accident, dying in 1881 and outliving Beaumont, who died in 1853 by 28 years. St. Martin died at the age of 78 years.

#### President James A. Garfield

At 9 30 in the morning on July 2 1881, shortly after entering a railroad station in Washington, D. C. President James A. Garfield (89) was approached by Charles J. Guiteau a Chicago attorney who shot at the President twice before he was stopped and apprehended. The first of the bullets from the assassin's revolver struck President Garfield in the right arm, producing a slight flesh wound. The second bullet entered the right side of the back, four inches to the right of the spinal

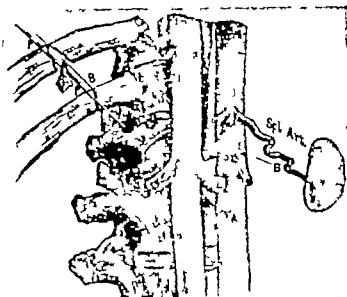


Fig. 18. Course of the bullet in the case of President Garfield. The diagram shows how the bullet fractured the right eleventh and twelfth ribs posteriorly, passed through the first lumbar vertebra and grazed the splenic artery and resulted in an aneurysm which upon rupture caused death (From Med. News, 1882, 40 678.)

column and on a level with the twelfth the lowest of the dorsal vertebrae, and passing at first forward fractured the eleventh and twelfth ribs, then deflected to the left, passed through the body of the first lumbar vertebra in an oblique direction to the left and emerging thence, passed behind and below the pancreas where it was found at post mortem examination. The second bullet in its course penetrated some of the branches of the mesenteric arteries and grazed the splenic artery.

Thus injured the President was returned to the White House where he was treated conservatively according to the customs of that day by a group of eminently capable surgeons. The wound in his back was probed several times. He was fed small quantities of liquid foods usually by rectum and occasionally by mouth. Opium was used for pain and among the other discomforts, he had to endure the annoyance of a hot and stifling summer heat. When the end finally came, the President, who when shot weighed 210 pounds, probably did not weigh more than 135 pounds.

On September 6 after several requests by their noted patient the surgeons in charge permitted removal of President Garfield from the White House to the Franklin Cottage in Elberon, New Jersey. His convalescence at Washington had been rather stormy and very trying both to the patient as well as to the attending physicians. When removed to Elberon he appeared to have improved somewhat and it was felt that the sea shore surroundings would hasten his recovery.

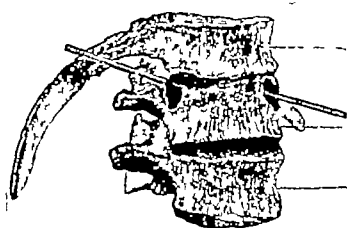


Fig. 19. Diagram showing the course of the bullet through the first lumbar vertebra in the case of President Garfield (From Med. News, 1882 40 678.)

However he continued to run fever and no additional improvement was noticeable as the days went by. On September 19 1881 at 10:35 in the evening President Garfield died suddenly.

At the autopsy (99) it was found that death had resulted from a ruptured aneurysm of the splenic artery. It was conjectured that the bullet had grazed the splenic artery producing a weakened area that resulted in the fatal aneurysm. The course of the missile was traced through the first lumbar vertebra, and the bullet was found in the abdominal cavity among the intestines (99) which had been removed early during the post mortem examination.

Most of the best surgical opinions of the time were in agreement with the manner in which the President's injuries were managed. However Sims, who was in Europe at the time, apparently permitted publication of interviews in which he said the President should have been celiotomized. Sims contemporaries, generally were not in accord with this opinion and some felt he should have refrained from allowing the publicity given his interviews.

#### President William McKinley

Late in the afternoon of September 6, 1901 while receiving the public in the Temple of Music at the Pan American Exposition (92) in Buffalo, New York, President William McKinley was shot twice by Leon F. Czolgosz, who approached the President with his right hand wrapped in a handkerchief in which he held the pistol. As the President went to shake the assassin's left hand the latter fired the first shot which struck the victim tangentially in the midsternum, only grazing the area and failing to enter the chest. The second bullet fired immediately after the first entered





Fig 80. President William McKinley (Buffalo M. J. 90 903, 57 7 (N.S. 41))

the abdominal wall 5 or 6 inches below the left nipple and about 2 inches to the left of the median line." The assassin was stopped from doing further damage, and in a very few minutes the President was placed in the hospital on the Exposition grounds.

Shortly after the injury the President was operated upon by M. D. Mann who was assisted by a group of other prominent surgeons. Many difficulties were encountered during the operation. In the first place, the hospital's facilities were not entirely adequate and there were not sufficient instruments for the celiotomy. Then there was the huge size of the victim which made adequate exploration very difficult. Finally as the operation was being completed the setting sun removed the best source of light, and an assistant surgeon was compelled to use a mirror with which he reflected the setting sun's rays into the operative field. When the operation was completed President McKinley was removed to the home of Mr. Millburn, President of the Pan-American Exposition.

The operation lasted 91 minutes. The surgeons first discovered a perforation of the stomach, and the opening in each wall was closed with continuous sutures. This required much time, mainly because of the President's size and the other difficulties already mentioned. Closure of the opening in the posterior wall of the stomach was accom-

plished by opening the lesser peritoneal sac, which made this part of the operation very difficult. It was at about this time that the President's condition appeared to grow worse, and did not warrant continuation of the operation. Accordingly it was stopped, the abdomen was closed, the wound dressed, and the patient transferred to Mr. Millburn's home in an ambulance.

Treatment of President McKinley continued very energetically at the Millburn home. Several prominent surgeons, among them Charles McBurney were called in consultation. A number of special nurses attended to the President's needs. After several days it seemed he would recover. However toward the end of the week his condition grew worse and then went steadily and rapidly downhill. He died on September 14, 1901 at 2:15 in the morning.

The autopsy performed by H. R. Gaylord, showed, in addition to the abrasion of the chest, perforations of the anterior and posterior surfaces of the stomach, which had been sutured a peculiar and not fully explained condition of the superior surface of the pancreas, near the tail, which was possibly the result of injury by the missile and probably had much to do with the fatal termination of the case, a slight laceration of the superior pole of the left kidney and possible injury to the left suprarenal gland.

#### *Senator Huey P. Long*

The late Senator Huey P. Long's importance in American history is based essentially upon the new and extraordinarily peculiar philosophy with which he had aroused the interest of the entire country at a time when the United States was still very unsteady as the result of the devastations of a depression unparalleled in the history of this nation. This philosophy had made him a national figure of great prominence and his untimely death cut short a career which many believe would have meant much progress for the United States. On the other hand, many were of the opinion that he was a demagogue of unusual ability and some felt certain that America was heading for a dictatorship with him as the dictator.

Because Senator Long was the victim of a penetrating gunshot wound of the abdomen, it has been deemed proper to include this case with the others briefly outlined. Thus far the writer has failed to find any report of this case in the medical literature. It is firmly believed that nothing of the case's surgical history has been published, except the incomplete and unreliable newspaper medical accounts of this tragedy. As none of

these have appeared sufficiently authentic to be reliable the writer has had to contact each of the physicians who supervised, or in any way assisted in, the treatment administered. Dr. Arthur Vidrine, who was in charge of the patient but unable to give access to the hospital record nevertheless discussed the case with the writer, who immediately afterward made notes of the necessary and important facts. Brief accounts of the surgical facts in the case were likewise given the writer by Drs. William H. Cook and Cecil O. Lorio each of whom assisted preoperatively, as well as at the operation, and each of whom saw the Senator after the operation. A questionnaire sent to 'Our Lady of the Lake Sanatorium, where Senator Long was treated, was adequately filled out and returned to the writer.

Although many in Louisiana are of the belief that Senator Long was the victim of a bullet wound received at the hands of his 'panicky' bodyguards (50) during the scuffle which followed the approach of Dr. Carl A. Weiss toward Long many others are nevertheless of the opinion that it was a bullet from the .32 caliber Spanish make automatic in the hand of the young doctor which entered the body of the Senator. Be that as it may the fact remains that Senator Long was shot in the corridor of the Louisiana State Capitol at about 9:30 on Sunday night of September 8, 1935, as he left the Governor's Office.

The bullet which struck Senator Long entered just below the border of the right ribs anteriorly somewhat lateral to the midclavicular line. The missile perforated the victim's body making its exit just below the ribs on the right side posteriorly and to the inner side of the midscapular line, not far from the midline of the back.

Upon realizing the extent of his injury the Senator in company with several friends hurried downstairs, got into an automobile and was driven to the hospital, which was only a few blocks away. There arrangements were made for an emergency laparotomy with Vidrine in charge. While preparations were being made Lorio assisted in the preoperative management and watched the pulse and blood pressure. Shortly after the victim's arrival in the hospital he went into profound shock and presented clinical evidence of internal hemorrhage. Finally when the systolic blood pressure dropped to about 90 and the pulse rate climbed above 110 the Senator himself said, 'Come on let's go be operated upon' (31).

Under ether anesthesia the abdomen was opened by an upper right rectus muscle-splitting incision. Very little blood was found in the peritoneal cavity. The liver, gall bladder, and stom-



Fig. 21 The late Senator Huey P. Long.

ach were free of injury. A small hematoma, about the size of a silver dollar, was found in the mesentery of the small intestine. The only intraperitoneal damage found was a 'small' perforation of the hepatic flexure which accounted for a slight amount of soiling of the peritoneum. Both the wounds of entrance and exit in the colon were sutured and further spillage was stopped. The abdomen was closed in layers as usual.

The postoperative course of the case continued steadily on the downgrade. Evidence of shock and internal hemorrhage appeared to become progressively worse. Sometime shortly after the celiotomy, Dr. Russell Stone of New Orleans suggested catheterization and the urine was found to contain much blood. At this time Stone's opinion was that another operative procedure to arrest the kidney hemorrhage would certainly be fatal, and as a matter of fact advised against it. At about 1:30 on the morning of Long's death he was seen by Dr. P. Jorda Kahle, New Orleans urologist, who aspirated the right perirenal area and upon withdrawing pure blood very easily concluded that there was a massive retroperitoneal hemorrhage. By this time, there was evidence of a marked bronchorrhea, the patient was practically moribund and any further surgery was deemed most inadvisable. The continuous intravenous drip was stopped. Although each of several blood transfusions seemed to result in a temporary improvement it was usually not long again before the

blood pressure began to drop and the pulse to become weak. By early morning of September 10, it was very obvious that further treatment would be useless. Hence, in spite of all efforts by an excellent group of physicians and surgeons, the Senator's condition continued rather precipitously on the downgrade and he died at 4:05 in the morning on Tuesday September 10 1935 about 30 hours and 36 minutes after being shot.

Although Vidrine tried to get permission, Mrs. Long objected to an autopsy and consequently none was performed despite the fact that a New Orleans pathologist was on the scene and ready at the time of Long's death. Death undoubtedly resulted from uncontrolled hemorrhage and shock. Lório was later of the opinion that the renal vessels had probably been torn by the bullet in its course through the body. Certainly without the energetic postoperative treatment, especially the frequent transfusions of blood, death would have very likely supervened much sooner. Although no autopsy was performed the condition of the intra-peritoneal viscera and other structures, and the course of the bullet—which was rather unmistakable because of the entrance and exit points—pointed rather suspiciously to an injury of the right kidney and possibly of the right renal vessels as the source of the hemorrhage. The fact that Senator Long died in slightly more than 30 hours, in spite of an unusually large number of blood transfusions, would seem to indicate that the injury to the vessel, or vessels, which undoubtedly continued to permit the escape of blood as fast as it was administered, was quite large.

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# ABSTRACTS OF CURRENT LITERATURE

## SURGERY OF THE HEAD AND NECK

### EYE

**Congenital Impatency of the Nasolacrimal Duct.**  
DuPort GUYARD III and EDWIN L. KENNEDY JR.  
*Arch. Ophth., Chic., 1943, 39: 193.*

The term congenital dacryocystitis, is a misnomer since the dacryocyst is merely results from stasis and the underlying condition is an impatency of the nasolacrimal duct. The lacrimal system usually becomes patent throughout in the eighth intrauterine month. Twelve instances of congenital impatency were noted in a consecutive series of 200 newborn infants—an incidence of 6 per cent. In 10 cases the epiphora first appeared between the tenth and twelfth day after birth but in 2 cases tearing was delayed 3 and 4 weeks respectively. Penicillin ointment instilled 3 times daily reduced the discharge, the conjunctival injection and the incrustation of the lids. In this series all cases cleared without probing, the longest interval being 5 months the shortest 3 weeks. Involvement of the left side was predominant.

In a later series 5 cases were observed in which the congenital impatency persisted after 6 months. Probing cleared the condition immediately. They advise the use of Bowman's No. 1 probe through the superior punctum. With slight upward rotation the probe finds its way into the sac and duct without forcing it. The inferior turbinate has been previously shrunk by adrenalin and after the probe has reached the nasal floor a submucous elevator is passed in the inferior meatus until the probe is encountered. A sharp metallic click should be heard and felt, unless the probe is covered with a cushioning layer of membrane. If such happens, the probe is vigorously rubbed with the elevator until bare metal is felt. After this the Bowman probe is passed through the inferior canaliculus in order to be assured of the patency of that structure.

JAMES E. LEANESBORN M.D.

**Fat Embolization Involving the Human Eye.** MILO H. FRITZ and MICHAEL J. HOGAN. *Am. J. Ophth., 1943, 3: 527.*

The greatest number of cases of fat embolism follow traumas of the soft parts of the body and, more particularly fractures of the long bones of the lower extremities. Nontraumatic causes, such as diabetes, childbirth, or injections of oily substances, are undetermined. The marrow fat, source of most emboli, usually is liberated from the cells by direct rupture, as in a fracture or by concussion from a blow. The vessels in the bones are held within the rigid haversian canals, and do not collapse following the injury; the liberated fat enters these torn vessels during or following the injury. This fat passes through

the venous system to the right side of the heart and pulmonary circulation, where fine emboli lodge in the capillaries of the lungs. Some of the fat may pass through into the general circulation and result in systemic emboli.

Two main forms of the disease may be encountered: the pulmonary—which may be either immediate, developing soon after the injury or delayed, commencing the third or fourth day; and the systemic—with more particular involvement of the nervous system, leading to restlessness, excitement, delirium, convulsions, and coma. Death occurs in from 1 to 6 days.

Reports of ocular findings are extremely rare. Only one case was found in the literature (EVANS, 1940). Another case is reported by the authors.

After the explosion of a gasoline stove a 21 year old soldier sustained multiple compound fractures of the long bones, ribs and pelvis, in addition to rupture of the bladder and was admitted to the emergency hospital in shock. After treatment of the latter an open reduction of the tibia fractures was performed. Immediately following the operation, the patient's condition was good. Suddenly the next morning, a very marked change took place. The patient was unconscious and reacted sluggishly to stimulation. Pupillary reactions were reduced. A flaccid paralysis of the arms, and a temperature of 103.5°F were noted. Coma continued until the time of death.

The ophthalmoscopic examination, under mydriasis, showed in the fundi some round and oval, white, subretinal exudates surrounding completely both maculae and following the course of the main vessels; there were no hemorrhages. The macula in the right eye appeared cherry red. The diagnosis of fat embolism was made based upon the following considerations: (1) the presence of fat in the urine (2) coma in a man with multiple fractures (3) coma in a man without signs of intracranial pressure (4) an eye-ground examination which showed embolic phenomena involving the retinal vessels (5) multiple petechial hemorrhages of the skin and conjunctiva, (6) chest films revealing a cotton ball appearance in the parenchyma of the lungs. The patient died on the tenth postoperative day.

The general pathology protocol reported a generalized fat embolization and a terminal pneumonia. The ocular sections were stained with sodan IV. The examination revealed some diffuse edema and round-cell infiltration of the ciliary body. Several small capillaries showed fat emboli. Several vessels, just beneath the choriocapillaris and near the optic disc, contained fat emboli. The principal changes in the eye occurred in the retina. Scattered fine hemor-

rhages were noted in the nerve fiber and ganglion cell layers. Focal areas of secondary degeneration were seen in the inner portion of the retina and in and around these areas, the terminal arterioles and capillaries were dilated and contained fat emboli which stained with sudan IV. In some areas the capillaries had ruptured and fat lay in the retinal stroma. A number of capillaries of the optic nerve also showed fat emboli.

MICHEL LOUZFALLAH, M.D.

**General Treatment of Conjunctivitis (Tratamiento general de las [conjuntivitis])** RAUL ARTURO CHAVIRA. *Anales med Mex.* 1947 8:1

There is no general agreement regarding classification of the various forms of conjunctivitis. The author divides the subject into contagious noncontagious septic atypical and that due to avitaminosis. These groups are again divided into numerous subgroups based mostly on anatomicopathologic findings.

Treatment of these various conditions is prefaced by a dozen rules of therapy founded primarily on general principles of eye therapy such as the use of cold compresses, guarding the orbit, the correction of systemic diseases and the use of sedatives.

The description of the treatment of the specific forms of conjunctivitis includes a discussion of mucopurulent purulent membranous granular follicular and paravascular types as well as those due to avitaminosis. Therapeutic formulas are given in each instance as general and special corrective measures.

STEPHEN A. ZIEMAN, M.D.

**Denig's Operation for Trachomatous Pannus.** N. PINZA. *Brit J Ophth.*, 1948, 32: 385

Denig's operation is suitable for the third or fourth stage of trachoma when the disease is nearly quiescent in the conjunctiva but still active in the cornea, as evidenced by progressive and stubborn pannus formation. It consists of resection of a strip of conjunctiva at the limbus adjacent to the pannus one half as wide and as long as the involved area. It is important that all of the tissue to the episclera be removed. The defect is then covered with oral mucosa fixed with silk to the conjunctival, but not corneal edges of the wound. The graft if it takes is pink and edematous at the first dressing and there is striking improvement in the clarity and appearance of the cornea.

The author discusses the rather considerable literature concerning the operation about which there is much controversy as to its benefit whether the mucosa forms an impenetrable wall against the invading trachoma and the fate of the graft.

Two cases are presented in which the operation caused improvement in a troublesome recurrent, trachomatous pannus. Histological study of the graft in one of these patients 12 years later showed the structure of mucous membrane slightly modified by stunting of the papillae and acanthosis. In another patient a tremendous serpygious ulcer occurring late

in the course of trachoma healed. Examination of the graft 19 years later showed the structure of mucous membrane. One case of trachomatous pannus aggravated by local irradiation was not improved by the procedure although the graft took.

The author recommends more frequent use of mucous grafts for any plastic operation of the trachomatous eye.

FRANK W. NEWELL, M.D.

**Degeneration and Regeneration of Nerves in Corneal Transplantation; an Experimental Study** HUMBERTO ESCARFANI. *Arch. Ophth. Chic.* 1948 39: 135

The corneal graft in rabbits is insensitive to a light cotton touch for the first few weeks after operation. This insensitivity is also found in the 2 mm of host cornea that surrounds the graft. Recovery of sensation was first noted at about the forty-fifth day. The intensity of response gradually increased till about the seventieth day but never reached the normal threshold. Physiologic tests indicate that after keratoplasty 90 days is required for each millimeter of reinnervation.

When a corneal graft is cut the severed corneal nerves undergo wallerian degeneration. Degenerative changes are also observed in the nerves of the host cornea in an area of about 2 mm around the graft and in this area both the degenerative and the regenerative changes progress more rapidly. In 30 days the majority of axons are no longer recognizable. Elongated nuclei are seen lying in a clear halo which occupies the space left by the disappearance of the myelin sheath. The plasmatic sheath is defined by the sheath of Schwann to which these nuclei belong. There is complete granulation of the nerve fragments. In 60 days the axonic debris has completely disappeared the old nerves being reduced to empty tubes. Since no macrophagic reaction takes place one may assume that the disappearance of the axonic debris depends exclusively on the Schwann cells.

To enter the graft the outgrowing axis-cylinders must pass through the organizing connective tissue at the line of junction of the graft. At the scar growth proceeds slowly the regenerating axis-cylinders taking a wavy course the majority finally growing into the Schwann sheaths left empty by the disappearance of the old axons. As the number of regenerating axis-cylinders increases maturation takes place. This consists of an increase in the caliber of the axons and a realignment of the Schwann nuclei.

Reinnervation follows the same course in clear and opaque grafts but in the opaque graft maturation is slightly retarded. The regenerative changes eventually result in complete histologic innervation of the graft.

JAMES E. LEIBENSOHN, M.D.

**Anterior Lentiglobus. An Atypical Case.** K. S. S. *Brit. J. Ophth.*, 1948 32: 305

The author presents a case of anterior lentiglobus an extremely rare condition in which the lens has a

small globular projection at the anterior pole. It consists of clear cortex only but the area becomes highly myopic and interferes with vision. The condition gets progressively worse and eventually an anterior polar cataract develops. The cause of the condition is not known. The anterior capsule of the lens may be weakened and allow herniation of lens cortex through the weakened capsule.

EARL H. MERR, M.D.

**The Capsular Complications of Cataract Extraction**  
CHARLES GOULDEN *Proc. R. Soc. M. Lond.*  
1943, 4, 37

The author considers the capsular complications of cataract extractions and the best method of averting them.

1. The capsular remnant may become adherent to the operation scar and in some cases glaucoma results. The remnant should be detached early with a blunt-ended knife through a keratome incision.

2. Opaque capsular membranes or after-cataracts may be of several types: (a) opaque lens fibers imprisoned between anterior and posterior capsular remnants, (b) new gray lens fibers from proliferating sub-capsular cells, (c) Elschnig's cells, (d) heavy thick membrane following hemorrhage and (e) thick membrane following infection.

The treatment may be any one of the following: (a) make a capsulotomy incision in the thin membrane avoiding thick bands, (b) double needle knives may be used if it is feared that pull and tug on tough membrane may cause trauma, (c) a Wheeler incision may be made, or (d) a Ziegler needle knife may be used to incise a triangular hole in the capsule.

Care is taken not to penetrate through the posterior lens capsule and allow vitreous to mix with the lens material.

The author is firmly convinced that intracapsular cataract extraction will be a great help in reducing capsular complications.

EARL H. MERR, M.D.

**Amblyopia ex Anopsia; A New Concept of Its Mechanism and Treatment.** B. M. LARSEN.  
*Irish Opthol. Chcn.* 1943, 30, 83.

According to the author amblyopia ex anopsia results primarily from deviation of the visual axis from the fovea to a point elsewhere on the retina where vision is less acute. If the patient uses the amblyopic eye to fix at a lighted ophthalmoscope bulb at about meter distance it will be apparent that the corneal reflex is eccentrically placed, the distance from the visual axis being proportionate to the degree of amblyopia. The field in the stereocomplimeter shows the blind spot in the amblyopic eye to be displaced in a direction that coincides with the displacement of the visual axis.

Treatment should aim at correcting the malprojection and restoring the true visual axis relationship of object to fovea. This is accomplished by exercises in eye-hand co-ordination. At first large white board is presented on which are pasted vivid red discs, which with successive treatments decrease in

diameter from 4 inches to  $\frac{1}{4}$  inch. With the good eye occluded the patient attempts to place a thumb tack in the center of each disc. The tacks at the beginning are invariably outside the disc, and in the same relative position. To encourage eye-hand training the patient is permitted even to use his hands and feel his way into the disc. The next step is the copying of letters from a chart, pointing out each letter as copied. The illumination is by an intermittent flashing light and the letters become progressively smaller as the vision improves. After 20/70 acuity is reached, the training is combined with a variety of exercises for the development of fusion.

Almost any age group can be treated successfully. Among the cases cited is that of a woman aged 41 years, with 20/400 vision in the amblyopic eye. At her ninth treatment she had second degree fusion and an acuity of 20/25.

JAMES E. LESTERHOEN, M.D.

**Glaucomas.** PETER C. KRONFELD and H. ISABELLE MCGARRY. *J. Am. M. Ass.* 1943, 36, 957.

The specific object of this study has been the establishment of the relationship between the course of the glaucomatous involvement of the optic nerve and the prevailing range of tension in the various stages of glaucomas. The report is based on the observation in the Glaucoma Clinic of the Illinois Eye and Ear Infirmary of definite (not borderline) cases of so-called primary glaucoma in adults. The classification as to the stage of the disease was based entirely on perimetric findings. Three stages (early, moderately advanced, and far advanced) were distinguished and somewhat modified from Gjesing's three groups.

The report is based on 225 eyes with wide-angle and 100 eyes with narrow-angle glaucoma. The ratio of success to failure of miotics was 27 to 88 or 31 per cent of successes in the wide angle type, and 35 to 40 or 88 per cent in the narrow-angle glaucomas, which showed that the miotics were much more effective as tension lowering agents in narrow angle than in wide-angle glaucomas. The dramatic course of narrow-angle glaucoma is apt to scare the patient and surgeon into early operation which might have been made unnecessary by the application of stronger miotics. The chronic course of wide-angle glaucoma on the other hand is conducive to an attitude of procrastination on the part of the physician as well as of the patient especially if there is no rapidly progressive loss of field. This explains why 3 cases of wide-angle glaucoma were permitted to remain with tension not normalized for 3 years.

With regard to the results of surgical treatment the results in the two groups are probably better than expressed by the statistics, the ratio of success to failure being 31 to 6 in the narrow-angle, and 34 to 5 in the wide-angle glaucomas. The large majority of the operations in narrow-angle glaucoma were iridectomies. The reason for this difference between the two types of primary glaucoma in response to therapy lies in the difference in mechanism. There

is good evidence to the effect that in narrow angle glaucoma the trabecula canal of the Schlemm mechanism is and remains normal until the trabecular spaces are completely closed off from the anterior chamber by goniosynechia. The aim of the treatment is to keep the trabeculae accessible to the aqueous which is easily accomplished with miotics or an iridectomy.

On the other hand in the majority of wide angle glaucomas the disturbance is probably due to impaired function of the trabecular canal of the Schlemm mechanism itself, and is therefore much more deeply rooted than in the narrow-angle glaucoma. Failure of miotics calls for an operation of the filtering type the success of which is still dependent on factors not completely understood and not entirely under the control of the operator.

In wide-angle glaucomas the course of the glaucomatous involvement of the optic nerve may be summarized as follows:

The eyes of stage 1 act as one would expect glaucomatous eyes to act, the course of the disease of the optic nerve showing a close dependence on the prevailing tension range and the independence of the relationship being rare enough to be considered an exception. In stage 2 the striking feature is the large percentage (38) of further progression of the glaucomatous involvement of the optic nerve (in this group in which tension was normalized surgically). In stage 3 the further progression of the disease in tension-normalized eyes was still greater (50 per cent). Twenty three per cent of the group in which the tension was not normalized showed the remarkable feature of endurance of high tension ranges without further loss.

In narrow angle glaucomas under conditions of non normalization, the glaucomatous disease progressed rapidly to total blindness. Under conditions of normalization the disease remained stationary during the 5 year period, and for longer periods in approximately 90 per cent of all tension normalized eyes, irrespective of the stage at which the normalization took place. Further progression occurred in less than 10 per cent of the normalized eyes of stages 2 and 3 which is a strikingly low percentage compared to the wide-angle glaucomas. Therefore it can be said that the later stages of glaucoma showed a strong tendency toward further progression of the disease despite normalization of the tension.

The type of operation that produced the normalization did not seem to be an important factor as the three main types of operation (corneosclerectomy, iridectomy, and cyclodialysis) were represented in about the same frequency in the surgically normalized eyes presenting further progression of the disease.

The very center of the visual field seemed to exhibit a specific resistance to glaucomatous disease. Its chances of survival (83 per cent) after normalization of tension were estimated and reported for the respective stages of the disease.

MICHEL LOUTVILLAN M.D.

## EAR

Some Clinical Phenomena of Deafness in the Light of New and Old Tests of the Ear F. KORRAK  
*Arch. Otol. Chlc.* 1948 47 113.

The author states that the otologist should test the hearing not only with audiometric tests but also with tuning fork and vestibular tests. These are especially important in the diagnosis of latent congenital deafness. The tuning fork tests which are important are:

1 Loudness test. The loudness of the patient's threshold for each individual tuning fork is estimated by the examiner.

2 Period hearing. The period during which the patient can detect a tone from each tuning fork is compared to the normal.

3 The audiometric provocative test. A loud audiometric tone is placed on the untested ear while a Rinne test is done on the opposite ear. The normal response on the tested ear is a negative Rinne test. This is because of the damping effect on air conduction, of contraction of the middle ear muscles.

The author offers the following definitions: hereditary deafness is defined as those cases in which the next of kin show manifest deafness and congenital deafness as those cases in which latent abnormality of the genes can be detected by special methods of diagnosis. In congenital deafness the audiometric examination and loudness with tuning forks may be normal. However, period hearing with the 1,024 and 512 tuning forks may be less than one half normal. Audiometric provocative tests may show a positive Rinne test instead of the normal negative Rinne test. Vestibular abnormalities are not infrequent.

An explanation is offered also for the false Rinne test in which a totally deaf ear manifests a negative Rinne test. It is believed that the apparent hearing by bone in the deafened ear is due to a cochleovestibular sensation because of some vestibular directional sensitivity. The older explanation of Shambaugh was that the hearing was tactile sensation via the trigeminal nerve. The author cites an experiment to support his contention. A medium intensity audiometer tone (d7) is placed on the deaf mastoid. A loud tuning fork of a different frequency (ex) is placed on the normal mastoid. The patient's sensation consists of the loud tone on the normal ear first then two different frequencies lateralized to the middle of the head and finally as the tuning fork dims the only sensation is the medium tone of the audiometer in the deafened ear. WILLIAM K. WRIGHT M.D.

## NOSE AND SINUSES

Intranasal Extension of Sellar and Parasellar Neoplasms. STANTON A. FRIEDBERG. *Laryngoscope* 1948, 58 347.

Neoplasms arising in and about the sella turcica may invade the sphenoid sinuses, nasopharynx, and nasal cavities. The most common of these are the



pituitary adenomas and chordomas. In the 3 cases presented the diagnosis of the type of lesion was made by microscopic examination of tissue removed from the nasopharynx or nasal cavities.

Headache primary optic atrophy bitemporal hemianopsia, and alterations in the roentgenographic appearance of the sella turcica are characteristic of pituitary tumors. Chromophobe adenomas, comprising from 80 to 90 per cent of all pituitary tumors, produce generalized adiposity, diminution of secondary sexual traits fatigability a lowered basal metabolic rate and an elevated sugar tolerance. Nasal obstruction postnasal discharge and occasional blood streaked sputum are the most common symptoms of nasopharyngeal or nasal extension of the tumor.

Complete removal of the tumor is impossible. Irradiation with roentgen rays and radium, or transfrontal, trans-sphenoidal, and paranasal surgical removal, alone or in combination, all have adherents.

Chordomas have their origin in vestigial remains of the fetal notochord. Cranial chordomas usually begin at the junction of the sphenoid and occipital bones in the region of the sella turcica. The microscopic picture is extremely variable. One of the diagnostic features is the presence of large vacuolated hyperchromatic cells. The signs and symptoms are those of a brain tumor or nasopharyngeal growth with headache ocular disturbances, nasal obstruction or discharge and epistaxis.

Radium and roentgen therapy are of no proved value for chordomas. Local recurrences are common however palliative relief may be achieved by removal of accessible tumor by surgical diathermy.

All patients with suspected anterior or middle cranial fossa tumor should have a careful nasopharyngeal examination. The necessity for microscopic study of all nasal polyps is again emphasized.

JOHN R. LINDSEY, M.D.

**Benign Cysts of the Antrum. Originating from the Jaw or Teeth.** W. A. NEWLAND. *Laryngoscope*, 61:3, 58: 402.

Radicular cysts and dentigerous cysts arising from the teeth may enlarge to encroach upon the maxillary sinus.

The radicular or root cyst has its origin in a root granuloma. The granuloma develops secondary to pulpitis. Cyst formation proceeds by dissolution of the center and connective tissue proliferation of the periphery of the granuloma. Further enlargement results in erosion of alveolar bone and invasion of the antrum.

Dentigerous cysts develop from the tooth sacs of retained or supernumerary isolated tooth germs. They develop around the crown of the tooth and may contain one or more deformed teeth projecting into the cyst space. These cysts have a dense fibrous three wall with areas of thin, shell-like bone, and a compact epithelial lining.

The surgical procedure found to be successful in the 2 cases presented was as follows:

The anterior wall of the maxillary sinus was exposed and opened through the canine fossa approach whereby the cyst was opened. The cyst lining was removed completely except that a portion of the floor was left undisturbed if its removal seemed liable to create a fistula through the palate or to disturb the blood supply to the adjacent teeth. A large nasolabial window was made. JOHN R. LINDSEY, M.D.

## MOUTH

**Langer's Lines and Facial Scars.** LEOHARD R. RUTHER. *Plast. Reconstr. Surg.* 1943, 3: 147.

The author emphasizes the importance of skin lines for obtaining fine linear scars. It has been pointed out that an elective incision in direction with the lines would heal with little scar. Heretofore, the explanation was two-fold: a scar parallel to the lines would be inconspicuous because it resembled a line. The other explanation was the misunderstood thought that Langer's lines ran in the same direction as the muscles, avoiding pull on the wound edges. The first explanation holds, but the second does not. Actually the muscle pull tends to separate the wound edges, widening the scar. This fact must be understood if cosmetic surgery is a *prima facie* factor. A scar against skin lines stands out prominently. Knowing the danger of muscle pull, the surgeon can take measures to overcome it by very careful suturing and postoperative care. Briefly outlined, the important things to remember in obtaining a fine scar are: (a) the suturing of all deep tissue in layers (b) placing superficial subcutaneous sutures to take all tension off skin edges (c) putting the finest sutures very closely together in the epidermis and removing them no sooner than 3 days. Since active healing is only starting at that time, the wound edges should be held by collodion strips (fine mesh gauze fastened by collodion across the wound edge). These strips should be applied and reapplied for at least 3 weeks, preferably 3. Constant care to have anatomical parts at rest to avoid muscle pull, should be observed.

LOUIS T. BYARS, M.D.

## NECK

**Proteolytic Activity in the Physiology Pathology and Therapeutics of the Thyroid Gland.** Van Meter Prize Essay E. DE ROBERTIS. *West. J. Surg.* 61:4, 56: 333.

The thyroid gland stores its secretion inside the follicular cavity as a colloidal substance containing thyroglobulin, and the secretion released into the circulation is a continuous process, the velocity of which is governed by the organism's needs. With the freezing-drying technique, the author demonstrated that cytological products of secretion are located within the cells and reabsorption is always intracellular. Since, however thyroglobulin is actually a macromolecule its passage through the follicular epithelium cannot be explained on the basis of the ordinary concepts of cell permeability.

The author therefore tested the presence of proteases in the colloid extracted from single follicles of the rat thyroid. Under magnification and with micropipettes guided by a micromanipulator a proteolytic enzyme which digests a gelatin substrate, was obtained. Its activity was found to be increased in the acid range and diminished in the alkaline. Similarly after the injection of thyroid stimulating hormone proteolytic activity was heightened and after prolonged iodine administration it was decreased. The determination of the pH of the follicles by the microinjection of indicators showed no marked changes after the administration of thyroid stimulating hormone or iodides which could explain the variations.

This led the author to propose the theory of enzymatic reabsorption which postulates that enzymatic hydrolysis of the thyroglobulin into a product of lower molecular weight (probably an iodized polypeptide) makes possible reabsorption by the cells. Theoretically it may be that the proteolytic enzyme is also involved in the synthesis of thyroglobulin.

The degree of proteolytic activity of normal and pathological human thyroid tissue was measured photometrically by determining the amount of liberated tyrosine and tryptophane on an edestin substrate at pH 4 and expressed as milligram equivalents of tyrosine per 100 mgm of tissue. Under arbitrarily fixed conditions the proteolytic activity of 10 normal glands yielded on the average 0.444 mgm. Under the same conditions in 11 severe toxic goiters the proteolytic activity was found to be about 96 per cent above that of the normal gland. In 5 cases of nodular toxic goiter a difference of at most 100 per cent was found between the proteolytic activity of the adenoma and that of the surrounding thyroid tissue. In 7 simple diffuse colloid goiters there was a decrease of proteolytic activity corresponding to 27.9 per cent of the normal. In 7 mild cases of toxic goiter in which the symptoms including the elevated basal metabolism rate were rectified by treatment with iodine, the proteolytic activity was decreased to about 26 per cent below the normal level. This led to the conclusion that the proteolytic system may play an important role in the physiopathology of toxic and simple colloid goiters.

That inhibition of proteolytic activity is the basis for the therapeutic effect of iodine is suggested by the results of experiments on rats and in mild toxic goiter. This may be due to an inhibition of the release of the colloid as well as of hormonal synthesis. In vitro studies indicate that direct iodization of the proteolytic enzyme may be the mechanism responsible for the inhibition. Similarly radioactive iodine was found to inhibit the formation of diiodotyrosine and thyroxine.

Thiourea has no action on proteolytic activity but acts on a totally different mechanism inhibiting the enzymatic system involved in iodization. It is suggested that the effectiveness of iodides, when given with thiocompounds, may be due to their interference with the action of thyroid stimulating hormone.

DAVID H. LYNN, M.D.

**The Effect of Sex Steroids on Experimental Goiter and Iodine Storage in the Thyroid.** F. X. GASSNER, H. W. BARRETT and R. G. GUSTAVSON. *West J Surg* 1948 56 346.

The authors review the literature on the interrelationship between the thyroid ovary and pituitary and conclude that experimental results are inconclusive and contradictory because of the elasticity of the physiological equilibrium in the normal animal, which makes it difficult to demonstrate mechanisms of inhibition or stimulation. The authors postulate that if a given organ can first be unbalanced by imposing stress then subsequent inhibition or stimulation of that organ can be produced more easily. Experimental work is reported in which the effects of gonadal hormones on the thyroid were studied after the thyroid was subjected to stress by maintaining the animal on a goitrogenic diet.

In the first experiment 30 micrograms of estrone were injected daily over a period of 12 weeks into normal female rats 8 weeks of age which were fed a moderately low iodine goitrogenic diet. There was a highly significant decrease in the iodine content of the thyroid glands, the mild goiter occurring on the control diet was alleviated the pituitary weight was doubled, and exophthalmos occurred unexpectedly in all of the rats after the third week of injections.

In the second experiment 40 micrograms of testosterone propionate were injected daily over a period of 12 weeks into normal and castrated male rats 26 weeks of age which were fed a low iodine goitrogenic diet. There was a highly significant decrease in thyroid iodine content in the normal animals and a nearly significant decrease in the castrated ones. Control castrated animals showed partly goitrous and partly atrophic thyroid parenchyma with follicular degeneration. These changes were alleviated with testosterone. Pituitary enlargement following castration did not respond.

The writers suggest that pituitary hypertrophy in estrone treated females is compensatory as a result of interference with either the production secretion or utilization of thyrotrophin by excess estrone. This pituitary hypertrophy was not seen in intact males despite a significant reduction in the thyroid iodine and a slight alleviation of the goiter. Therefore the mechanism responsible for thyroid depression in the female either is not the same as in the male or it is activated to a different extent.

S. LLOYD TITHEMAN, M.D.

# SURGERY OF THE NERVOUS SYSTEM

## BRAIN AND ITS COVERINGS CRANIAL NERVES

**Intracranial Aneurysm of the Internal Carotid.**  
**Operation.** Cure (Aneurisma intracerebralis de la carótida interna. Operació Curado.) GORDON HUGO THICKMAN, LEON ZIMSKAN and ALFREDO M. ZELASCO *Cirurgi* 947 44

A 46-year-old, white woman awoke at 4 a.m. with intense pain in the left frontal and parietal regions. Ten minutes later blepharoptosis and amaurosis occurred on the left side. Examination disclosed also left sided anisocoria, papilledema, anesthesia of the trigeminal region and paresis of the oculomotor, trochlear and abducens nerves. During the preoperative stay in the hospital the ptosis diminished and vision improved and the eye regained partial movement (inward rotation). However the pains persisted and ear noises developed on the affected side. The condition was recognized as the syndrome of Rollet (paralysis of the second, third, fourth, fifth, and sixth cranial nerves) and under the diagnosis of intracranial aneurysm of the left internal carotid the artery was ligated by the technique of Dandy. It was ligated first in the neck. 8 days later a left temporal flap of the skull was lowered and 2 silver clips were applied to the internal carotid artery where it was easily accessible alongside the optic nerve.

As the middle cerebral cavity was exposed the cerebral tissues were observed to be under tension, the optic nerve was elevated and the artery at this point was dilated with abnormal congestive conditions about it, so that it did not have its normal appearance but seemed to be inclosed in a thick mesh of congested vasa vasorum vessels.

Following the operation the symptoms of increased intracranial tension decreased immediately and the headaches became less severe, the mental condition of the patient returned to normal, and she was able to resume her occupation. The trigeminal anesthesia persisted and the eye movements did not entirely return to normal, the internal rotation has persisted and will be the object of eye-muscle surgery.

The authors think that this is the first instance of this condition with a successful surgical outcome in Argentina, and offer the report merely as an addition to the statistical material on the subject.

JORDAN W. B. BERNARD M.D.

**Cerebellar Abscess, Acute, Orogenic** \ ANDERSON  
*J. Lar. Otol. Lond.* 948, 67: 78

This extraordinary article is the report of 3 cases of cerebellar abscess. The author apparently reported 4 consecutive successful cases in 1913 thus making 7 consecutive cases of cerebellar abscess. Two additional cases are reported to illustrate what may happen to cerebellar abscesses. The present 3 case reports substantiate the previously reported 4 cases.

The article consists of day-by-day reports and progress notes of these 3 cases.

The article opens with a discussion of early diagnosis of cerebellar abscess and a differential diagnosis between cerebellar and temporoparietal abscesses, and the following assertions are made:

1. When the cerebrospinal fluid pressure in the tranquil patient was below 200 mm. of water the suspected brain abscess was below the tentorium (cerebellar).

2. When the pressure was above 300 the abscess was above the tentorium.

The cases since encountered confirm the postulates previously adumbrated.

It is believed that the most important sign however is persisting nuchal rigidity which is regarded as the keystone of early diagnosis. Nystagmus and arm symptoms are next in order of importance. The invariable sequence is described as persisting nuchal rigidity and with the onset of dyadokokinesis the diagnosis becomes certain.

The author believes that these cases should not be abandoned to the neurological surgeon. Early drain age once the abscess has been diagnosed is emphasized.

ANDREW VON BRUNNEN M.D.

**Pinealoma (Pinealoma)** JOSE BENAIM. *Dis. medice*, B. Afr. 948 for 430.

The frequency of these neoplasms is not great however they should not be considered exceptional.

The pathological forms are as follows: pinealoma spongiosoblastic, malignant pinealoma, teratomas or teratoid fibromas, sarcomas, gliomas, gliosarcomas, neurogliomas, neuroepitheliomas, carcinomas, adenomas and cholesteatomas.

The symptoms produced by these tumors may be classified into the following groups: (a) intracranial hypertension, (b) localization symptoms, (c) endocrine and (d) typical. Radiological signs are present.

Intracranial hypertension is due to the occlusion of the Sylvian aqueduct by the tumor, this results in an internal hydrocephalus which causes papilledema.

The symptoms of localization are ocular disturbances, impaired hearing due to the involvement of the posterior quadrigeminal tubercles and the lateral lemniscus, motor disturbances from pressure on the pyramidal tract in the medulla which produce weakness in one or both extremities, asynergy from pressure on the superior cerebellar peduncles, and symptoms of diabetes insipidus from invasion of the third ventricle.

Endocrine involvement results in an increase in size with sexual precocity before puberty, increase in the size of the external genitalia, increase in pubic hair, adult voice, and mental precocity.

Röntgenograms may show calcification of the gland with displacement. Pneumoventriculography

is of help in visualizing any obstruction to the aqueduct, while ventriculography is of some value. However, arteriography is of minor importance.

The situation of the pincal mass rather than their histological type makes the prognosis very grave.

Treatment is surgical, radical, or the combination of both. When the incision is made over the tumor the excision is accomplished either through the corpus callosum or transventricularly. In the indirect intervention either a decompression or a derivative type of intervention with re-establishment of the circulation of the cerebrospinal fluid is used.

The author reports 2 cases of pinealoma. In the first case the symptoms were typical with an early hypertensive syndrome, a pseudo-Argyll Robertson pupil, bilateral mydriasis, the syndrome of Parinaud, asynergy of the trunk, involvement of the fifth, sixth, ninth, and twelfth cranial nerves and cerebellar symptoms. X-ray examination revealed intracranial hypertension while ventriculography revealed a large bilateral hydrocephalus.

In the second case there was some increased sexual development in a 17 year old male having the syndrome of Parinaud, Argyll Robertson pupil and intracranial hypertension. The surgical result was good.

ARTHUR F. CIRIELLA, M.D.

#### Diploic Epidermoid and Extradural Pneumatocoele;

Cranial Defects and Deformity. JOSEPH E. J. KIRO, *Ann Surg* 1948, 127, 925.

Two uncommon types of cranial defects are discussed and detailed case reports of 4 patients operated upon by the author are presented. Diploic epidermoid and extradural pneumatocoele of spontaneous origin each have a characteristic appearance in the roentgenogram and should be diagnosed before operation. The neurological findings, roentgenographic diagnosis and operative technique are presented for each of the 4 patients. Reproductions of roentgenograms as well as photographs of the patients and the surgical specimens clarify the text.

Diploic epidermoids usually destroy the inner table of the skull and may perforate the dura before the outer table is destroyed. Islands of bone in the outer table represent areas in which bony destruction is not complete, and a dense white scalloped margin with bone destruction is characteristic on roentgen examination. The tumor does not invade the bone but destroys by compression. The mass may occupy a relatively large amount of intracranial space compared with the smaller diameter of the defect in the skull. The involved bone should be resected and if the dura has been perforated a fascial transplant may be necessary. If the dura is not resected the bone block may be reinserted after curettage and boiling of the bone segment. Repair of the bony defect should be deferred for several months in patients with larger defects in whom dural resection and fascial transplant is necessary.

Extradural pneumatocoele of spontaneous origin without perforation of the skull is discussed and 2

cases are presented. The position of the internal opening of the air fistula sometimes is not known preoperatively. The author states that no other lesion produces such a coral rocklike picture of the skull. A venous erosion of the skull occurs as a result of the air pressure and in some places the skull is almost completely destroyed. The dura is usually adherent to the depressed cortex and the author cautions against attempting to fix the dura to the bone. The involved segment of bone should be resected. After removing the bony spicules of the segment it may be used to repair the cranial defect. The intracranial extradural opening of the air fistula should be found and closed with a fascial or muscle fascia transplant.

JOHN L. BRETZ, M.D.

#### PERIPHERAL NERVES

Cervicobrachial Pain. C. E. HAGGART, *J Am M Ass* 1948, 135, 505.

Twenty patients with neck and arm pain were studied and divided into 2 groups: those with abnormal x-ray findings and those without such findings. The patients with the abnormalities revealed cervical rib (3), cervical disc (3), degenerative arthritis (3) and cervicodorsal scoliosis (1).

The patients who revealed no abnormal x-ray findings presented the scalenus anterior syndrome (4), the costoclavicular syndrome (3) and the hyperabduction syndrome (3). In one case the symptoms developed following trauma.

The method of treatment consisted in correcting vitamin B deficiency, the result of inadequate diet by the administration of vitamin B complex three times daily. Mild analgesics were also used and finally faulty posture and occupational habits were corrected.

There is a short reference to some of the authors who have in the past contributed to the understanding of this type of pain and there is reference to Wright's work on the hyperabduction syndrome. There is also a short bibliography.

AUDREY V. BRUNNEN, M.D.

#### SYMPATHETIC NERVES

Raynaud's Phenomenon and Atypical Causalgia: the Role of Sympathectomy. L. RAY, *J Clin Invest* 1948, 27, 720.

The author limits his report to the role of sympathectomy in Raynaud's disease and atypical causalgia states. These conditions are characterized by marked vasospasm without obliteration of vascular channels. He interprets the presence of hyperhidrosis, coolness, cyanosis, cold sensitivity, and color changes as indicative of vasospasm. He believes the mechanism of vasospasm to be neurogenic and examines for it objectively by regional procaine block of the sympathetic ganglia. For the upper extremity, block of the stellate ganglion with 10 c.c. of one half per cent procaine is done and for the lower extremity a single injection of 30 c.c. of one half per cent pro-

caloe is introduced through a 7 inch needle placed at a 40 degree angle to the sagittal plane in the region of the second and third lumbar vertebrae. Skin temperature determinations and clinical observations are made before and after sympathetic ganglion block.

A total of 30 cases of Raynaud's phenomenon were seen. Five of the patients were operated upon. The operations were preganglionic cervicodorsal sympathectomy and lumbar preganglionic sympathectomy. They were completely successful in 4 of the patients and only partially successful in the other patient. The author believes that a conservative attitude toward the surgical treatment of Raynaud's disease is proper and that sympathectomy should be done only in severe and rapidly progressive cases with sclerodermatous and ulcerative changes.

Sympathectomy has been successful for atypical causalgic states in which the pain does not limit itself to the anatomic distribution of an involved nerve for patients in whom there has not been a long history of edema in the lower extremities, and for those who have a marked sensitivity to cold.

DANIEL ROGE, M.D.

#### MISCELLANEOUS

**Myocardial Infarction Resulting from Surgical Removal of the Stellate Ganglion in Angina Pectoris** (*L'infarctus du myocarde accident de la stellectomie dans L'angine de poitrine*). D. DANIELOPOLU  
*Presse med.* 945, 56-537

Evidently Danileopolu warned, as early as 1932, that removal of the stellate ganglion for the relief of pain in angina pectoris would be fraught with dangerous consequences. This article is based on the work of others reported in the literature but principally the paper of Lindgren and Olivecrona in the *Journal of Neurosurgery* in 1947. Lindgren and Olive-

crona operated on 71 patients with angina pectoris selected from a group of 250, the operation consisting of the removal of the upper four thoracic and the inferior cervical ganglia. In a large proportion of the cases the operation was bilateral. Three patients died during operation and 8 developed myocardial infarction in the first 30 days after operation; 3 of the latter died. Thus, Danileopolu states that 15 per cent of the patients treated surgically for angina sustain myocardial infarction because of this operative procedure. He considers that the article of Lindgren and Olivecrona supports and in fact establishes, his original contention.

The reason for the infarction lies in the function of the cardiac nerves removed by the operation, both sensory and motor nerves being removed. The motor nerves are coronary dilators and their removal leads to permanent vasoconstriction which is a serious element in coronary disease. Acute cardiac failure is also found more often in surgically treated patients although this condition is seen less often since all the patients with angina are no longer operated upon. A myocardial infarction in nonsurgical cases is produced so slowly that the collateral circulation has time to become established, whereas this does not occur in surgical cases. The operation of Olivecrona is compared to resection or simple removal of the stellate ganglia alone, and this is considered less objectionable for fewer accidents are said to occur. Certainly the mortality rate is much lower in stellectomy than in the more extensive removal of the upper part of the thoracic sympathetic chain. According to Danileopolu, this is a matter of statistics in which nonsurvivors are not interested. He believes that there should be a close follow up of these 71 cases, and he has little doubt that further complications will ensue. The relief of pain is not discussed.

ADRIAN VAN BROOKHUIS, M.D.

# SURGERY OF THE THORAX

## CHEST WALL AND BREAST

Present Day Criteria for the Treatment of Breast Cancer (Critério atual no tratamento do câncer da mama) ANTÔNIO PRUDENTE. *Rev. brasil. cancerol.* 1947 1: 11

In this article the author reviews the evolution of the treatment in cancer of the breast and states that it is indicative of medical and surgical progress generally. Such progress embraces not only surgery itself but likewise the fields of pathology, roentgenology and endocrinology.

Breast tumors with particular reference to malignant ones, can be grouped under the following clinical classification:

- Stage 1: Tumor confined to the breast itself
- Stage 2: Axillary involvement with movable nodes
- Stage 3: Axillary involvement with fixed nodes
- Stage 4: Supraclavicular involvement with movable nodes
- Stage 5: Breast tumor fixed to the chest wall with fixed supraclavicular nodes, cutaneous extensions or distant metastases

In brief summary lesions in stage 1, particularly those of low grade malignancy histologically, can be treated by simple mastectomy accompanied by removal of the pectoral fascia. In young women a reconstructive or cosmetic type of mastectomy seems justified.

Tumors in stage 1 or 2 with higher grades of malignancy (histologic grades 2, 3 and 4) should be subjected to radical mastectomy (Halsted).

In stages 3 and 4, that is, tumors presenting a fixed axillary mass or accompanied by movable supraclavicular nodes, a more radical approach in the form of mastectomy and interscapulothoracic amputation is indicated. Supraclavicular dissection and resection of the axillary vessels as an extension of the Halsted type of operation should not be undertaken, because the result of such a limited approach in these cases is disappointing.

Electrosurgical techniques offer significant advantages provided that coagulated tissue of sufficient amount to interfere with wound healing is not produced.

Röntgen therapy is at its best when used to complement surgical treatment in the highly malignant types (histologic grade 4) of medullary carcinomas and papillary cyst adenocarcinomas. In inoperable cases it will bring about local and symptomatic improvement. Castration by x-ray treatment is indicated in far advanced cases with osseous metastases. It is simple to carry out.

Testosterone propionate used after mastectomy in stages 1 and 2 is considered to have produced better results than those obtained by mastectomy alone. Statistical references to the author's material in this

regard are given. Gratifying relief was obtained in the inoperable cases from intensive treatment with testosterone propionate.

HIRAM T. LANOSTON, M.D.

## TRACHEA, LUNGS, AND PLEURA

Bronchial Lavage (El lavado bronquial) BENJAMIN NOCE. *Rev. med. cir. Habana* 1947 53: 537

Even with the adjuncts of bronchoscopy and bronchography, the diagnosis of pulmonary tuberculosis in certain cases remains doubtful because of the lack of demonstration of the causal agent, the tubercle bacillus. This occurs even in patients raising sputum but in patients who have no sputum demonstration of the bacillus is more difficult, although gastric lavage is frequently employed as an aid. In an attempt to increase the number of patients in whom the tubercle bacillus can be demonstrated positively the technique of bronchial lavage has been devised, organisms being found in material recovered from the tracheobronchial tree following induced coughing.

Abreu of Argentina first reported this work in 1944 although Castillo is said to have used the method in 1943 without publishing his results. The technique described here is essentially that of Castillo and is as follows:

With the patient supine but his head elevated, the base of the tongue, uvula, and pharynx are anesthetized with a 1 per cent novocaine. A catheter is then introduced through the nose into the pharynx. The patient is placed with the suspicious side down and novocaine is then injected into the bronchial tree. After 5 minutes from 20 to 40 c.c. of sterile physiologic serum are injected via the catheter into the tracheobronchial tree. The patient is thus caused to cough and all of the expectorated material is collected. Particular attention must be paid to the amount of anesthesia produced so as not to suppress completely the cough reflex on the one hand or to affect the reflex so little that the patient gags and swallows the material instead of aspirating it. The collected material is carefully mixed with alkali and incubated 24 hours. It is then centrifuged, washed neutralized, recentrifuged, put on a slide, dried, stained, and examined for the presence of acid-fast bacilli.

The procedure appears to be indicated in patients with a suspicious pulmonary shadow but with no sputum or negative sputum in patients having positive sputum previously but which has become negative on treatment, patients who by the usual methods are said to be cured or their condition inactive, the family members of patients with positive sputa, and patients with chest lesions that are diagnostic problems. The chief contraindication is found in patients with recent hemoptysis although asthmatics in an acute crisis should not be subjected to the

procedure. No serious accidents or complications following the procedure have been reported.

The author reports 20 cases studied by bronchial lavage in which the usual methods had failed to demonstrate the tubercle bacillus. He found 19 of these to be positive on stained smears of the expectorated material, a percentage of 95 per cent. Thirteen of these had revealed no sputum and 7 had repeatedly revealed negative sputa. Five patients had had gastric washings without successful demonstration of the bacilli. Among the 20 cases all types of pulmonary tuberculous lesions were revealed by means of the lavage.

In the comparison of the positive results from bronchial lavage with those of gastric lavage, a review of the reported statistics shows a range of from 0.5 to 5 per cent positives, with an average of 47.2 per cent, for bronchial lavage, and a range of from 60 to 4 per cent positives with an average of 32.22 per cent for gastric lavage. The author reports 95 per cent as the highest. He considers the method an extremely important one in the questionable and difficult cases but points out that further proof by inoculation of the collected material into guinea pigs is needed to confirm the results obtained by the stained smears. JESSE E. THOMPSON, M.D.

Tracheobronchial Tuberculosis (Traqueo-bronchitis tuberculosa). MANUEL RODRIGUEZ DUTRA. *Rev. dermatol.* 945, 8, 24.

This article presents a review of the experience in the management of tracheobronchial tuberculosis during one year. It represents 533 bronchoscopies in 343 patients. There was no significant difference in incidence between men and women. There were only 3 patients below 20 years of age.

The incidence of tracheobronchial lesions in this group was 74 cases, the largest percentage incidence occurring in the age group over 40 years (31.7%).

Bronchoscopy was not used routinely in all tuberculous patients. The principal indications were signs of bronchial obstruction, radiologic evidence of obstruction, unexplained positive sputum, or clinical evidence of inadequate bronchial ventilation as determined by the behavior of a pneumothorax. When the indication included clinical signs of bronchial obstruction, disease was seen in 51.2 per cent of the cases examined in pneumothorax failures, in 36 per cent, and in cases with unexplained or persistent positive sputum in 22.7 per cent. The contraindications to bronchoscopy were extensive laryngeal ulceration, severe hemoptysis, acute upper respiratory infections, and excessive dyspnea.

There appeared to be no correlation between the demonstration of tracheobronchial lesions and the duration of the disease although such lesions were predominant in the cavernous type of pulmonary lesion (60.8% of demonstrable tracheobronchial lesions occurred in patients with cavernous lung disease).

The author points out that in this series, mere mucosal changes were not catalogued as definite lesions.

only those cases wherein the presence of a bronchial lesion was unequivocal and definite being included. He classifies them into four types: (1) infiltrative (38 cases)—hyperplastic mucosal lesions not infrequently accompanied by epithelial erosion; (2) ulcerative (21 cases); (3) ulcerogranulomatous (11 cases); and (4) fibrostenotic (4 cases).

The lesions found corresponded in localization to that of parenchymatous disease quite closely. In 4 cases the lesion involved the trachea. The upper trachea of the bronchial tree were most frequently involved and in only 1 instance was a lesion found on the side opposite the pulmonary disease.

The author emphasizes the importance of not aggravating the seriousness of demonstrable bronchial lesions in denying the patient suitable collapse therapy. The mere presence of a visible lesion without definite obstruction need not necessarily preclude the adoption of such measures. These lesions were generally treated topically with 30 per cent silver nitrate and the author claims healing in 32 per cent, improvement in 28 per cent, no change in 34 per cent, and progression of the disease in 6 per cent. Electrocoagulation has been used with success, but because of its apparent propensity to produce heavy scars, stenosis may result. Promin given locally is ineffective. Ultraviolet light and radiation therapy were not used. Streptomycin has been used and dramatic results are cited, but its scarcity has precluded any adequate trial. The author reviews the argument against the effective use of local treatment but believes it to be valuable even if not the entire answer to the problem. HIRSH T. LANGSTON, M.D.

Wet Lung—An Experimental Study. ROLLIN A. DAMEL, JR., and WILLIAM R. CATE, JR. *Ann. Surg.* 945, 7, 836.

A series of carefully controlled experiments produced traumatic wet lung in mongrel dogs by both blunt trauma and tangential bullet wounds of the thoracic cage. The term "wet lung" denotes the accumulation of fluid in the lungs following accidental or operative trauma. The fluid consists of blood transudates, exudates, or mucous in any combination. The phrase pulmonary edema which in its strict sense implies an increase in interstitial fluid often is loosely applied to the condition known as wet lung.

The pathologic picture is one of extravasation of blood in the lung and the transudation of fluid into the interstitial spaces as well as the alveoli and bronchi. The amount of fluid produced in each experiment varied directly with the degree of trauma. The pulmonary fluid appeared rapidly after thoracic trauma. It was still present in proportion to the trauma inflicted, at 24 hours and had largely disappeared at 72 hours. Even in those areas of the lung exhibiting no gross evidence of trauma fluid could be demonstrated, frequently in considerable amounts. However, the greatest degree of pulmonary wetness was found in the areas of greatest hemorrhage in the traumatized lungs.

Intravenous infusions of isotonic sodium chloride in amounts and at rates of injection which have little effect on normal animals intensified the wetness of a slightly traumatized lung. Generalized pulmonary edema resulted. The authors believe that anoxia per se does not explain the wetness in grossly untraumatized areas of the lung following thoracic injuries.

Studies of the arterial oxygen saturations, hematocrits, peripheral venous pressures, peripheral arterial blood pressures and the pulse rates in the experiments did not reveal variations of enough significance to explain the occurrence of generalized wet lung associated with localized areas of pulmonary injury.

In an effort to explain the occurrence of fluid in the nontraumatized areas of the lung, experiments were performed which indicated that generalized wetness following local trauma to the thoracic cage and the lung is in part a reflex neurogenic phenomenon.

ORVILLE F. GRIMES, M.D.

**Pneumoconiosis Due to Talc in the Cosmetic Industry** NATHAN MILLMAN *Occup. M.* 1947 4:391

The report of a case of pneumoconiosis due to talc is presented. The author emphasizes the fact that contrary to prevailing beliefs, prolonged exposure to talc in sufficient concentration is capable of producing generalized pneumoconiosis of the nodular type. The elements of silica and asbestos were eliminated as a cause of the pneumoconiosis in this particular patient since there had been no exposure to these substances in any industry prior to his exposure to talc in the cosmetic industry. Also, the chemical analysis of the talcum powder revealed less than 0.5 per cent free silica.

ORVILLE F. GRIMES, M.D.

**Situs Inversus, Bronchiectasis, and Sinusitis—the Kartagener Syndrome. Report of 2 cases.** (Transposición de visceras—bronquiectasia y sinusitis Síndrome de Kartagener) JUAN MARTÍN ALLENDE and LÁZARO LANGER. *Cirugía* 1947 1:176.

The association of bronchiectasis and true dextrocardia was first described in 1904 by Siewert, but few references to this condition appeared in the literature until Kartagener described the triad which bears his name in 1933, consisting of situs inversus, bronchiectasis and paranasal sinusitis. He reported 4 cases at that time, later collecting 7 more.

The literature on this subject, as well as that relating to the association of upper and lower respiratory tract disease is briefly reviewed. The etiology of bronchiectasis cannot be given any more certainly under these circumstances than in its uncomplicated status, but it does seem that in persons with situs inversus, bronchiectasis may well appear more frequently.

The first of the authors' cases was a young man age 17 with a long history suggestive of bronchiectasis. He had a transposition of thoracic as well as abdominal viscera, and clinical as well as roentgen

ographic evidence of maxillary sinusitis. Bronchography revealed a lower lobe bronchiectasis in the right chest, which contained in anatomical pattern a left lung. Lower lobe lobectomy was performed with relief of the symptoms.

The second case was that of a girl 14 years of age. Birth was complicated by atelectasis of the left lung. She presented a complete transposition of the viscera and clinical as well as roentgenographic evidence of maxillary sinusitis. Bronchography revealed bronchiectasis in the left chest, involving the middle lobe of what was in anatomical pattern a right lung. A successful lobectomy of the middle lobe was performed.

These patients were treated in 1946 and 1947 respectively.

Twelve references to the literature are given.

HIRSH T. LAROSTON, M.D.

**Cancer of the Lung in the Female** (Cáncer del pulmón en la mujer) ANDRÉS A. SANTAS. *Boletín Inst. d'Onco.* B. Air. 1947 23:134.

It has long been known that pulmonary cancer is much more frequent in men than in women. Various authors report the incidence in women to be between 12 and 20 per cent except in Argentina where the figures are lower, ranging from 2.5 to 11 per cent. The author reviewed the 350 cases examined in the Institute of Clinical Surgery in Buenos Aires between 1933 and 1941 and found only 7 females, an incidence of 2 per cent.

The cause of the greater incidence of pulmonary cancer in men is unknown. The part played by tobacco and industrial occupations has long been discussed but with the increased use by women of tobacco and the widespread employment during the war of women in factory jobs formerly occupied by men, there has been no reported equality or even increase in the relative incidence of pulmonary cancer in the female. In general, one must look to the fundamental biological differences in the two sexes as manifested in their specific hormonal secretions to account for the difference but just how this comes about is unknown.

Bronchogenic carcinoma in the female has the same histologic characteristics as in the male. Epithelioid carcinomas, adenocarcinomas and undifferentiated epitheliomas are recognized. There is disagreement in the literature in regard to the so-called endothelioma. Some authors consider it of vascular or pleural origin while others consider it a bronchogenic epithelial tumor. Such a tumor differs from the usual carcinoma however in that it is more frequent in the female, grows slowly, rarely metastasizes, gives a rounded homogeneous shadow by x-ray and is of low malignancy. One of the cases in the author's series was classified as hemangioendothelioma. Bronchial adenomas also appear to be more frequent in the female than in the male. A point of interest is that epidermoid carcinomas are relatively infrequent in the female, the adenocarcinomas being the predominant type. This fact cannot account for



the overall difference in incidence of pulmonary cancer in the female, however.

The author reports 7 cases of female patients with malignant pulmonary tumors among a total of 350 cases reviewed. In these neither tobacco nor industrial occupations were factors of significance. All of the women performed domestic duties. None suffered from any other chronic pulmonary disease. Five were from urban areas and 2 from semirural areas. Histologic proofs of the diagnosis were obtained in 6 cases, 3 by bronchoscopy, 2 by thoracotomy, and 1 by node biopsy. It was not possible to classify the type of tumor in 1 of these 6 cases. Of the remaining 5, 2 were adenocarcinomas, 1 was epidermoid carcinoma, 1 undifferentiated epithelioma and 1 hemangioperithelioma.

Among the total cases in the women patients epidermoid carcinoma was found in 1.7 per cent, adenocarcinoma in 3.63 per cent, undifferentiated tumors in 6.25 per cent, and hemangioperithelioma in 100 per cent. Among the 5 cases, adenocarcinomas represented 40 per cent, however, the series is too small to warrant any final conclusions.

JAMES E. THOMPSON, M.D.

#### Carcinoma of the Lung. Factors Affecting Survival after Resection of Cancer of the Lung. RALPH ADAMS. *J. Thorac. Surg.*, 1948, 17: 306.

During the 15 year period ending December 1945 the diagnosis of lung cancer was microscopically established in 182 patients at the Lahey Clinic, Boston. Fifty six, or 30.8 per cent of these were resectable. Of the 56, 8 or 14.3 per cent died in the hospital. This hospital mortality has now been reduced to 5.1 per cent during the past 5 year period.

Analysis of factors involving the survival of the remaining 48 patients shows the following:

**Duration of symptoms:** Approximately 60 per cent of all patients survived one year following operation regardless of the duration of the preoperative symptoms. Thereafter the rate of death with epidermoid cancer is directly related to the preoperative duration of symptoms. In cancers of other types the cell type is more important than the duration of symptoms.

**Site of lesion.** This does not affect the survival rate.

**Type of operation.** Thirty five of the 48 patients were resected by pneumonectomy and 13 by lobectomy. The survival rate was equally good for each type of operation but it should be remembered that patients with the more advanced lesions were treated by pneumonectomy.

**Survival with respect to nodal involvement.** The regional lymph nodes were involved in 18 of the 48 patients and not involved in 30. The absence of demonstrably involved nodes increases the patient's chance of being alive and well 5 years after the resection, three fold.

**P. signis in relation to cell type.** This is the most important singular consideration in the estimation of the prognosis after resection. In undifferentiated

cancers less than a year of life may be expected. Patients with epidermoid carcinoma have the best prognosis of long survival. The longest survival with adenocarcinoma has been 3 years. Broder's classification of the epidermoid carcinoma is confirmed as a prognostic aid in this group.

FRANK B. QUEEN, M.D.

#### ESOPHAGUS AND MEDIASTINUM

On the Pathogenesis and Surgical Treatment of Esophageal Diverticula. (Sobre la patogenia y tratamiento quirúrgico de los divertículos del esófago) L. PEÑA LOPEZ. *Rev. esp. pat. cir.* 1946, 4: 353.

Modern x ray examination has been the main factor responsible for the increased frequency of recognition of esophageal diverticula, and has made possible a definite diagnosis of certain symptom-pictures heretofore undiagnosed.

Diverticula of the thoracic esophagus apart from those due to traction from scarring arising in the hilar glands are congenital in origin. When symptoms are severe enough to warrant surgery, they can be treated by inversion of the sac into the esophageal lumen by excision of the sac and layer closure of the esophageal wall, or by Lahey's method of tacking the dome of the diverticulum superiorly to the side of the vertebral bodies which allows it to collapse and prevents food from entering it. These diverticula are quite uncommon as compared with those of the cervical type.

The pharyngoesophageal diverticula are those most frequently encountered. The pathogenesis of these lesions is still disputed. They arise in the weak triangular area of the pharyngoesophageal junction. Many authors consider congenital defects or alterations in the musculature in this area as the basic cause of the formation of diverticula. Others have called attention to the inco-ordination or spasm of the cricopharyngeus muscle during deglutition, with continued intermittent pressure on the weak esophageal wall as a factor. Probably all these factors contribute and over a long period of time the diverticula enlarge and begin to give their characteristic symptoms, consisting of regurgitation, dysphagia, bad breath, and, in later stages, compression of nearby structures—the recurrent nerve, sympathetic trunk, and trachea. Pathologically these diverticula show inflammation, with the formation of polyps and papillary projections, ulcerations which may perforate and malignant degeneration.

Lahey has divided these lesions into three stages (1) that producing no symptoms, (2) that in which there are symptoms without obstruction and (3) that with symptoms and esophageal obstruction. Ideally they should be operated on in stage 2 and those in the asymptomatic stage should probably not be operated upon.

The early surgical treatment consisted of a one stage excision of the sac but because of high mortality from infection a two-stage procedure was gradually evolved. This two-stage operation has been

championed by Lahey. In the first stage the sac is freed elevated with its dome superiorly, and externalized to allow for adhesions to seal off the mediastinum and fascial planes of the neck. At the second stage the sac is amputated and the stump either closed primarily or packed with a small piece of gauze and allowed to heal.

In recent years with the protection of chemotherapy and antibiotics the tendency has been toward a one-stage operation in which the sac is very carefully freed and amputated under strictest aseptic precautions, then a layer by-layer closure of the esophageal wall is done. The results of this method appear to be just as satisfactory as those of the two-stage method and the second operative procedure is obviated. Under certain circumstances arising at the time of operation, the two-stage maneuver may appear preferable. The author describes in detail the case of a large diverticulum treated successfully in two stages.

JESSE E. THOMSON M.D.

#### The Treatment of Carcinoma of the Esophagus and Cardiac End of the Stomach by Surgical Extirpation RICHARD H. SWEET *Surgery* 1948, 43: 952

Because of the anatomic and physiologic aspects of the esophagus surgery of this organ demands separate consideration, according to the various levels at which carcinoma occurs (Fig. 1). Surgery for carcinoma of the cervical segment of the esophagus utilizes a skin flap transplant. The operation is almost perfect from a standpoint of restoration of function, but is a failure as a measure of cure. Recurrence is inevitable, and prolongation of life cannot be insured.

Carcinoma of the thoracic segment involving the upper fourth of this region requires a thoracotomy incision through which the entire esophagus from the base of the neck to the cardia is dissected free and the stomach is completely mobilized. An esophagogastric anastomosis is performed within the neck, above the level of the clavicle. Although the operation has limitations, it is the most effective palliative method thus far devised.

Surgery for carcinoma of the middle half of the esophagus includes lesions superior to the aortic arch and those inferior down to the level of the inferior pulmonary vein. A high esophagogastric anastomosis is employed in the reconstruction whereas a low esophagogastric anastomosis is used in resection of carcinoma involving the lower fourth of the thoracic esophagus.

After infection is eliminated the most important immediate postoperative complications are cardiac arrhythmias and congestive failure. Antibiotics have materially reduced the occurrence of infection. An intranasal catheter for the administration of oxygen has been most efficient. Continuous Levine suction of the stomach, aspiration of the thoracic cavity and early ambulation have contributed to reduced mortality.

Radical resection for carcinoma of the esophagus offers the patient a survival in relative comfort with-

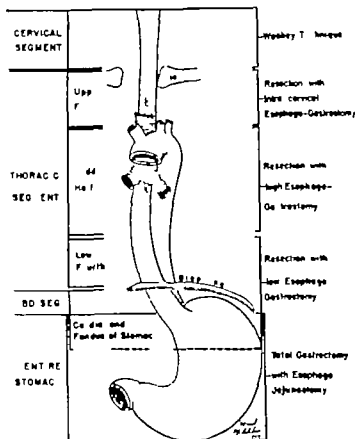


Fig. 1 (Sweet) Anatomic regions of the esophagus and cardiac end of the stomach illustrated to facilitate the understanding of the technical problems involved in the surgical management of carcinoma arising at various levels.

out dysphagia. Appraisal of the operation as a curative measure awaits the accumulation of cases showing the accepted 3 to 5 year survival time. As a palliative measure the operative approach has a positive value as demonstrated by the 303 resections reported.

STEPHEN A. ZIEMAN M.D.

#### Cancer of the Cervical Esophagus. WILLIAM L. WATSON and JOHN L. POOL. *Surgery* 1948 43: 893

The clinical material for this report consists of a consecutive series of 77 patients with cancer of the cervical esophagus admitted to Memorial Hospital New York, in the 7 year period from 1940 to 1947.

The results of treatment for cancer of the cervical esophagus have been discouraging up to the present time for a variety of reasons. Dysphagia the most prominent symptom of esophageal cancer at any level is usually a late symptom, because it does not manifest itself until there is fixation of a large enough portion of the pliable esophageal wall to cause sufficient blockage of the gullet to interfere with the passage of food. The esophagus does not contain pain fibers and therefore, symptoms are necessarily due to pressure on adjacent organs and structures. Early in the disease a feeling of roughness in the throat, halitosis, or slight vague and ill localized discomfort on swallowing occurs. The patient is

likely to shrug off these premonitory symptoms. When the disease is finally diagnosed the patient may be shuttled between the nose and throat specialist, the general surgeon, and the x-ray therapist unless he falls or is steered into the hands of a physician particularly interested in this disease and capable of treating it.

The lesion under discussion occurs in the upper 30 cm. of the esophagus, thus including a portion of the gullet which extends into the thoracic inlet. (lobus hystericus and thyroid disease are the two most frequent diagnostic errors encountered. The esophagus should be studied carefully under the fluoroscope not only with a thick barium suspension in order to outline the gullet, but also to assess the mucosal pattern after the bolus has passed. Esophagoscopy should be carried out in every suitable case as the next diagnostic measure. When leucoplakia is present in the mouth, an investigation of the esophagus is not amiss, as there is a definite association of precancerous leucoplakia in the whole of the upper digestive tract. The Plummer Vinson syndrome and carcinoma may be difficult to differentiate and it is possible for the two diseases to coexist. In the series of 13 women, 3 had sufficient evidence to warrant the diagnosis of Plummer Vinson syndrome. Other factors which may cause a disorder in the swallowing mechanism and which must be ruled out are prominent osteoarthritic spurs of the lower cervical vertebrae in the elderly, a retropharyngeal abscess, tuberculosis of the cervical vertebrae, recurrent laryngeal nerve paralysis, and thyroid or lymph node enlargements.

If a patient with carcinoma of the cervical esophagus is put on a high caloric, supportive liquid diet the life expectancy is approximately 3 months. A satisfactory gastrostomy increases life expectancy slightly. In two-thirds of the cases, x-ray therapy brings about some degree of amelioration of the symptoms and at least all the saliva to be swallowed. The life expectancy of a patient after x-ray therapy and gastrostomy is more than a year and an occasional patient may have complete arrest of the cancer.

There are three established methods of surgical attack on this problem of cancer of the cervical esophagus.

The Torek procedure is indicated in the high intrathoracic lesions, or those at the thoracic inlet. The cervical esophagus is brought out through the neck wound the tumor excised and the margin of the proximal esophagus sutured to the skin at a suitable level. A skin-lined anterior chest wall esophagus can be constructed later.

The radical operation for cancer of the cervical esophagus which invades the posterocoll region, the arytenoids, the thyroid gland or trachea itself and was described by Trotter, Eggers, and Woolsey each independently. It consists in resection of the larynx, esophagus, and the adjacent jugular lymph nodes en bloc. A preliminary gastrostomy is made, and a low tracheostomy provided under local anesthesia to furnish an airway and an opportunity to introduce

oxygen. At a later stage, the cervical esophagus is reconstructed by a skin lined tube turned in upon itself and sutured to the two ends of the esophagus.

3 Segmental resection a less radical resection, of the cervical esophagus is feasible when cancer has not extended completely through the muscular coat. This holds true even for those lesions at the cricopharyngeal pinchcock where the tumor is partially on the anterior wall. In such cases resectability without sacrifice of the larynx cannot be determined until exploration of the posterocoll space is undertaken. Lesions as low as the sternal notch can be resected in this manner. Preliminary gastrostomy may be indicated, and tracheostomy is essential.

Two methods are available for completion of the operation. If the lesion is particularly ulcerated and infected the esophagus may be exteriorized by suturing a Padgett graft behind it. From 4 to 7 days later the involved segment of the esophagus is resected. The authors prefer to resect the esophagus at this stage and suture the superior and inferior stoma to the replaced skin flap margins. A graft is often needed over the prelaryngeal muscles, and later tubular reconstruction.

In this series there were 11 operations on the cervical esophagus in 27 cases, an operability rate of 4 per cent. In 7 cases (64 per cent) the tumor was resectable. Of the 7 patients resected one died on the second postoperative day of pulmonary edema and myocardial infarction. The immediate convalescence of the other 6 patients was uncomplicated. Four patients were alive and well 7 years, 1 year 9 months and 6 months, respectively after resection without recurrence. Two were alive with recurrence 3 years and 3 months, respectively following surgery.

Cancer of the cervical esophagus, if discovered reasonably early in its course can be cured surgically and even when the disease is advanced and cervical metastases are present, a control of growth may be obtained by aggressive surgery plus substantial irradiation.

HAROLD LAUFMAN M.D.

**Seven Resections of the Thoracic Esophagus for Carcinoma, with Esophagogastric Anastomosis, followed by Operative Cure (A propos de sept résections de l'œsophage thoracique pour cancer avec anastomose œsophage-gastrique, suivies de guérison opératoire).** ALAIN MOUTON and P. VI. OUSSEY. *Mém. Acad. chir., Par.* 918, 74-65.

During a period of 3 months, the authors saw 13 cases of malignancy of the thoracic esophagus. Four of the patients were inoperable, but 9, between the ages of 33 and 68 were operated on. Two of the latter died of shock and pulmonary edema, 7 presented an operative cure.

According to the site of the tumor two different methods of operation were used. In the low tumors (4 cases) the left transpleural approach with resection of the eighth rib and section of the neck of the sixth and seventh ribs was used. The stomach was mobilized as far as possible toward the pylorus by severing the gastroduodenal ligament. The coronary

artery was ligated in order to remove the lymph nodes at the small curvature. The esophagogastric anastomosis was performed at the anterior aspect of the stomach.

In the high tumors (middle esophagus 5 cases) the technique of Garlock and Sweet was employed. This consisted of supraumbilical incision, liberation of the stomach and ligation of the small vessels of the mesoesophagus at the level of the hiatus. Then the abdominal incision was closed, the patient turned on his left side, a right thoracotomy was done parallel to the sixth rib and the tumor was dissected.

WERNER M. SOLMITZ, M.D.

**Surgery of the Thoracic Esophagus** (Sur la chirurgie de l'oesophage thoracique) F. D. ALLAINES and CH. DUBOST *Bleu Acad. chir.*, Par. 1948 74 151

Malignancies of the thoracic portion of the esophagus offer a poor prognosis in most cases because of early metastases in the mediastinal lymph nodes and invasion of the neighboring organs and because of the poor general condition of the patient at the time a correct diagnosis is made.

At the convention of surgeons in Paris 1947, the authors gave a report of 65 cases of their own observation. Fifteen of their patients were operated on and only 1 of these 15 was alive and well 8 months after the operation. Since last year however improvement of anesthesia equipment and shock treatment have made the prospect less gloomy. Four cases in which operation was done since October 1947 are described in detail. All of the patients survived.

If curative resection is impossible because of invasion of the lymph nodes and adjacent organs palliative resection is preferable to gastrectomy. Although the patient cannot be saved in the long run he can lead a comfortable life for some time and will not be subjected to the miseries of gastrostomy. The technique of palliative anastomosis between the esophagus and stomach without resection is described in detail, and six cases in which operation was done by this method are reported.

WERNER M. SOLMITZ, M.D.

**Acute Posterior Mediastinitis from Per-Oral Wounds of the Esophagus** (Les médiastinites aiguës postérieures par plaies endo-œsophagiennes) RAOUL JOUSSEMET *J. chir. Par.*, 1948 64 180.

The author presents a 10 year study of acute posterior mediastinitis resulting from wounds of the esophagus via the per-oral route. Esophageal perforations were shown to occur as frequently from instrumental maneuvers as from the ingestion of foreign bodies. The esophageal wall, composed of only mucous and muscular coats without a serosal layer is particularly vulnerable to traumatism. Perforations are most common in the cervical esophagus.

The anatomical arrangement of the several fascial planes leading into and away from the posterior mediastinum favors propagation of the infection with but little tendency toward localization. Likewise the negative pressure within the thorax, the constant motion of the mediastinal structures from movements of deglutition of the esophagus and the addition of infective agents from the saliva from repeated swallowing efforts tend to cause progression of the infective process. The abundant lymphatic supply of the posterior mediastinum is also a factor in the spread of infection introduced into the posterior mediastinum by endoesophageal wounds.

Two factors are important in the recognition and management of esophageal perforations incurred through the per-oral route.

1. The wound in the esophageal wall permits the entry of air into the periesophageal tissues which infiltrates along the fascial planes and along the great vessels. The presence of air is an important roentgen sign in establishing the diagnosis of an esophageal perforation.

2. The anaerobic nature of the organisms from their natural habitat in the mouth and pharynx makes for an especially virulent symbiotic bacterial relationship.

The immediate surgical repair of esophageal wounds through an adequate approach either cervical or high thoracic is advocated by the author and is substantiated by favorable statistics.

ORVILLE F. GRADY, M.D.

# SURGERY OF THE ABDOMEN

## ABDOMINAL WALL AND PERITONEUM

**Chronic Eventrations and Voluminous Herniations.**  
**Preparation by Progressive Pneumoperitoneum.**  
(Eventraciones crónicas y hernias voluminosas. Pre-  
paración con el neumoperitoneo progresivo. Proce-  
dimento original) IVÁN GÓMEZ MORAÑO. *Cirugía*,  
947 89.

Since 1940 approximately 80 cases of large hernias and eventrations have been prepared preoperatively by progressive pneumoperitoneum. Patients with umbilical hernias, relatively small foramina and flaccid ventral walls do not require preparation with pneumoperitoneum. However the procedure gives its maximum benefit to those patients with large rings tense abdominal walls, and above all those with postoperative eventrations.

The procedure as described has two principal actions: first, it reduces the disproportion between the abdominal cavity and its contents, second it alleviates the respiratory changes attendant upon a rapid postoperative rise in intra-abdominal pressure.

Intraperitoneal insufflations of air reproduce in miniature the postoperative picture. At first there is an increase in the intra-abdominal pressure elevation of the diaphragm and labored respiration. For this reason the first administration of air necessitates prudence. The second and third "pneumons" are all ways well tolerated and the quantity of air may be markedly increased. Another significant fact is that the vital capacity is not diminished at the end of 2 or 3 weeks even though the abdomen is under extreme tension.

In 2 or 3 weeks after four or five administrations of progressively increasing amounts of air up to 6 or 8 liters, the patient has no more than slight discomfort, while if the same patient had received from 500 to 1,000 c.c. of air at the first treatment, he would have had reactions of abdominal tension, dyspnea, and pain in the left shoulder. The vital capacity of the same patient, which was 1,500 c.c.m. before the initiation of treatment, dropped to 1,000 c.c.m. after the first treatment, then it was augmented and established at between 1,500 and 2,000 c.c.m. during the last treatment.

Upon opening of the abdomen under local anesthesia, the air is expelled and the patient experiences relief, the abdominal muscles are loose and the viscera do not protrude. Ordinarily spinal or general anesthesia are preferred.

The primary effect of the pneumoperitoneum is to reduce the edema of the peritoneal membranes, omenta, and adipose tissues, to exert pressure on the large dilated veins and as a consequence improve the venous circulation of the lower extremities reduce distention of the viscera, elongate adhesions and weaken the muscular tension so that tissues may be approximated without strain when sutured.

Secondarily as a result of the elevated intra-abdominal pressure due to pneumoperitoneum there is strengthening of the diaphragm as well as of the other muscles of respiration, stabilization of the vital capacity during treatment, increase of the vital capacity after operation, and improvement of the venous return as a result of the improved thoracic respiration.

The procedure should not be used in patients of advanced age, in debilitated patients, in decompensated cardiopathies or in strangulated hernias of many hours duration. Notwithstanding, the procedure may be used in 90 per cent of the general cases of eventrations.

Besides the immediate advantages of the method, it provides an excellent test of tolerance for the operation. A patient who would be incapable of tolerating even carefully graded doses of air in the abdominal cavity would not be a suitable candidate for the operative procedure. HAROLD W. BINSWORTH, M.D.

**Mesenteric Thrombosis.** J. E. MCCLENNAN and BEN-  
HARD FISHER. *Surgery* 94:3, 3 778.

In November 1944 Ficarra reported 569 cases of mesenteric thrombosis with 35 successful resections. Since then no large series has been reported. A review of the literature since Ficarra's article adds 7 more cases with 3 successful resections. To these are now added 40 cases with 5 successful resections, bringing the total to 616 cases with 43 (7 per cent) successful resections. Since there was an average of 10,000 admissions per year at the Mercy Hospital, Pittsburgh, it was found that the incidence was 1 case in 5,000 or 0.2 per cent.

Of the 40 patients, 23 were men and 17 were women. All 40 were white persons, no negro receiving the diagnosis in spite of the fact that many were admitted. In comparing the incidence with other places it was found that the Michael Reese Hospital in Chicago had 44 cases in 10 years. The Kings County Hospital in New York had 35 cases in 8 years.

Although the incidence of mesenteric thrombosis is greatest between the third and sixth decades, this condition may occur at any age. In one series the youngest patient was 27 years old and the oldest 81. Of these cases 57 per cent occurred between the ages of 40 and 60 years.

In a series of 40 cases, the diagnosis was definitely proved in 27 or 67 per cent by either operation or autopsy. Of these 27 cases, 11 came to autopsy, 16 of the patients were operated upon and 3 of these came to autopsy after operation. The remaining 13 cases, or one-third of the total, were diagnosed clinically and, of course, it was quite impossible to prove the diagnosis in that group.

The 3 cases of the condition not proved by operation or autopsy could be dismissed by saying that of this number 12 patients died, a mor-

tality of 98 per cent. Of these 13 cases, 8 were the result of primary heart disease 3 followed previous surgery, and 2 were primary in nature. Operation was not attempted in any of these cases because of the generally universal feeling by the surgeon that the patient could not tolerate surgery.

In the proved group of 27 cases, 19 patients were operated upon and 5 lived, a mortality rate of 73 per cent. In this group of 19 there were 6 in whom nothing but the diagnosis was established by opening and closing the abdomen. One cannot consider these individuals as having been operated upon in the ordinary conception of surgery. All 6 died. Of the remaining 13 upon whom some operative procedure was done, 5 or 39 per cent, lived. For all the cases in which some operative procedure other than just opening and closing the abdomen was performed the mortality rate was 61 per cent. For the group in which nothing was done, the mortality rate was 95 per cent. Thus, it would seem that surgery gives the patient about one chance in three to survive while watchful waiting has little to offer but death.

Radical surgery that is wide resection and anastomosis, is the only tenable treatment in those cases in which there is extensive gangrene of the bowel.

The condition may often present itself in a mild form not always as the severe accident as is so commonly believed.

The mortality rate of the patients in the Mercy Hospital was 61 per cent for those operated upon and 96 per cent for the remainder. The total mortality rate was 85 per cent for 40 cases.

A brief discussion of the anatomy and pathologic physiology was presented with emphasis on the col lateral circulation.

An outline of etiologic factors was presented and arterial thrombosis of atherosclerotic origin was the most common cause of the condition in the series.

The presentation of 2 cases demonstrated the clinical picture of this condition. The signs and symptoms are not consistent.

It is believed that the use of heparin and dicumarol must be considered. They may possibly be of great value postoperatively. HARRY W. FOX, M.D.

### GASTROINTESTINAL TRACT

**Cardioesophageal Cancers Treated via the Trans-thoracic and Transdiaphragmatic Route.** FELIX DE AUSTRI and ELISEO QUILA. *Surgery* 1948 23 921

In 39 patients with cardioesophageal cancer who were treated by the authors between September 1943 and September 1946 it was possible to perform radical operation in 14 (36 per cent). All of the lesions of the distal third of the esophagus or cardioesophagus were explored through the thorax by resection of the ninth rib and incision in the diaphragm. Nonresectable lesions were (1) those tumors which at exploration of the thorax were accompanied by hemorrhage freely collected in the pleural cavity, neoplastic nodules disseminated in the pleura (2)

adhesions en bloc with the diaphragm indicating an immovable tumor and very extensive infiltration, extensive invasion of the neighboring organs such as the aorta, bronchus, spinal column and (3) those which after incision of the diaphragm, were shown to be accompanied by liver metastases, implants in the adjacent peritoneum or the pouch of Douglas and extensive infiltration of the omentum or other intra abdominal organs.

The anesthetic was cyclopropane in each case and was administered by tracheal intubation.

Following 14 radical resections there were 6 survivals (43 per cent of the resections or 15 per cent of the total). The average survival time was 13 months among these patients.

The cause of death in those who underwent resection and died during the first 30 days after operation was acute pleuropulmonary infection (in 6 patients). In all autopsies revealed partial separation of the sutures of the anastomotic stoma. One patient died from operative shock and another of generalized peritonitis also due to separation of the sutures.

Commenting on their experiences the authors emphasize the low resectability rate, the route of primary exploration, the determination of macroscopic evidence of delimitation of the tumor and the fact that the suture line in the anastomosis is apt to disrupt. For the latter it is suggested that fine silk Halsted sutures be employed in the posterior part joining the gastric seromuscular layers with the esophageal muscularis layer. A continuous chromic catgut suture on an atraumatic needle is used by these authors to include all the gastric and esophageal layers in the posterior part. The same method is then used in the anterior circumference. Fine silk Lembert sutures are used for reinforcement in the entire circumference. The stomach should be fixed in the thorax at the edge of the diaphragm. A Levine tube, passed above the anastomosis was used for 5 or 6 days. Tension should be avoided on the anastomotic line. HAROLD LAUFMAN, M.D.

**The Roentgen Diagnosis of Cancer of the Cardiac Region of the Stomach.** ROBERT S. SHERMAN. *Surgery* 1948, 23 874

Since gross pathology is the foundation for reliable x ray diagnosis in gastric cancer a classification based upon morphology is used. Three types of carcinoma are recognized: polypoid, infiltrating and ulcerating. While most carcinomas contain more than one of these features, one usually predominates and permits classification. The diagnosis of an organic lesion roentgenologically is generally less reliable than its detection.

It is occasionally a problem whether a malignant tumor is of lower esophageal or of upper stomach origin. Mere identification of the bulk of the cancer above the diaphragm does not assure that it is esophageal, since intrathoracic gastric cancer is not uncommon. In the experience of the author most cancers involving the lower esophagus are found to

be of stomach origin. The various forms and degrees of herniation of stomach through the diaphragm may provide a stumbling block to the diagnosis of cancer of the cardiac region. One must exclude the possibility of intrathoracic gastric cancer in all hernia cases. In the obstructive lesions occurring at the lower esophageal orifice it is important to get enough barium into the stomach to be able to rule out gastric cancer. To accomplish this, the period of the examination may have to be considerably extended. If an air bubble is present, a careful study of its contour may provide essential information.

In a group of 205 resected carcinomas of the stomach at Memorial Hospital, New York, it was found that 2 per cent were located in the cardiac region. The author discusses the diagnostic details under the following headings: (1) mucosal alteration, (2) infiltrate, (3) mass, (4) ulcer, (5) esophageal involvement and (6) miscellaneous findings such as obstruction, gross contour changes, general widening between the fundus and the dome of the diaphragm, lateral displacement of the stomach at the cardia, and diaphragmatic alteration.

In checking the pathologic specimens with the roentgen diagnosis it was found that the judgment of the roentgenologist as to tumor size was about 50 per cent dependable. As for location, all ulcers involved the cardia to some extent and most of them had the cardia as their principal site.

It is emphasized that postoperative roentgenography should be used in the detection of recurrence.

HAROLD LAUFMAN, M.D.

#### **Surgical Treatment of Cancers of the Gastric Cardia** GEO. T. PACK and GORDON McNEER *Surgery* 94:8, 3:976.

This article is a summary of gastric cardiac surgery carcinoma as done in the Memorial Hospital, New York, New York. One hundred and twenty-two cases are listed including 65 cases of the author.

The procedure followed is given in detail from the first presentation of the patient for diagnosis to the postoperative follow-up. The anesthetics of choice are cyclopropan, either with nitrous oxide-oxygen and ethylene. The abdominal approach was employed in 10 patients, the transthoracic in 45, the abdominalthoracic in 6, and the transthoracic with total resection in 4.

The end-results were admittedly discouraging. Twenty-one patients succumbed as a direct result of the operation. Twenty-one others died from the continuance of the growth and metastases of the cancer. Of the remainder of the patients who are living 18 are with out evidence of recurrence.

STEPHEN A. ZIEGLER, M.D.

#### **Transthoracic Gastric Resection for Lesions of the Cardia of the Stomach and Lower Part of the Esophagus.** JOHN H. PAYNE and O. THORON CLARKE *Surgery* 94:8, 3:9.

The authors present a review of the cases in which transthoracic gastric resection was performed at the

Mayo Clinic, Rochester, Minnesota, for lesions of the cardia of the stomach and the lower part of the esophagus.

According to the authors this operation offers the best method of surgical management of malignant lesions of the lower part of the esophagus and the cardia and upper part of the fundus of the stomach.

Simple transthoracic exploration performed by the authors has not resulted in any deaths. Their immediate postoperative mortality rate for the cases in which resection was performed was 13 per cent.

Although the numbers are small, calculation by the actuarial method of Berkson indicates the following survival rates: 71 per cent of the patients lived for 1 year, 40 per cent lived for 2 years, and 31 per cent lived for 3 years.

#### **Perforated Gastric and Duodenal Ulcers. Statistics on 95 Observations (Úlceras gástricas y duodenales perforadas. Estadística sobre 95 observaciones)** P. LARGHERO YBARRI, L. M. BORN DEL MARCO, L. MIEROLA, and F. GUTIERA. *Arch. surg. med.* 94:7, 3:64.

Larghero *et al.* in a series of 95 cases of perforated gastric and duodenal ulcer studied in Uruguay found a gross mortality of 30 per cent. The cases were divided into three groups. In the first group were 33 cases observed from 1930 to 1940 with a mortality of 19 per cent; in the second were 29 cases followed from 1940 to 1944 with a mortality of 6.8 per cent, and in the last there were 33 cases followed from 1944 to 1946 with a mortality of 14 per cent. The authors found that the prognosis of these perforated cases depended on the time lost before the repair of the perforation was made. The prognosis is considerably more severe in cases with a perforation of longer than 15 hours duration.

In the diagnosis of the perforations the authors found that pneumoperitoneum was present in all 6 cases of perforated gastric ulcer in which roentgenograms of the abdomen had been taken, but it was evident in only 10 of 30 cases of duodenal ulcer. In the group of cases without roentgenologic evidence of pneumoperitoneum, the perforation occurred in less than 4.5 hours in 7, in 7 hours in 1 case, in 7.5 hours in another, and in 17 hours in the last case.

The type of surgery used was as follows: suture of the perforation in 43 cases with 11 deaths; suture and gastroenterostomy in 31 cases with 5 deaths; and gastrectomy in 7 cases with 1 death.

The authors also discuss the importance of the different types of anesthesia and the type of drainage as important surgical factors in decreasing the mortality of patients with perforated ulcers.

WILLIAM E. RICKETTS, M.D.

#### **Pathologic Perforation of the Ileocecal Colon (Perforación patológica del colon ileo cecal)** JULIO V. URIBARRI *Congreso*, 1947, 7:3.

Urbarruri discusses perforation of the ileocecal colon in pathological conditions. The author analyzed the history, pathological anatomy, etiology

pathogenesis anatomopathology symptoms diagnosis and surgical indications of these perforations of the ileosigmoid colon

According to the author the principles fundamental in the treatment of these types of perforations are suture of the communication between the perforated intestine and the free peritoneum drainage of the intestine and the peritoneum and the anti-infectious treatment with sulfa drugs and penicillin. Of 4 patients treated by the author 3 survived. Two of them had free perforations in the peritoneum and 1 had a 'blocked' perforation in the fourth perforation was considered "imminent"

WILLIAM E. RICKETTS, M.D.

**Tuberculosis of the Appendix (La tubercolosi dell'appendice)** PASQUALE FIGARA and UGO PAOLIAN. *Torino. Ann. Ist. Osp. Aquilani* 1946-47 1:277

The authors analyze 238 appendectomies performed at the Civil Hospital in Aquila, Italy. Of these 200 represented patients operated upon for appendicitis (without perforation) and upon whom bacteriological cultural and histological studies for tuberculosis were made and all were found to be positive in 2 cases. One of the latter showed calcified nodules pinhead in size on the cecum while the other showed no evidence of tuberculosis. Hence the authors concluded that primary tuberculosis of the appendix could be ascribed to only 1 case representing 0.5 per cent.

The other 38 cases represented those in which there was macroscopic evidence of tubercle in either locally or in the adjacent organs. In these cases the following procedures were carried out

Exploratory laparotomy	8
Appendectomy	10
Hemicolectomy and ileotransverse colostomy	3
Hemicolectomy in patient with previous ileotransverse colostomy	1
Appendectomy with hysteropexy	1
Appendectomy with hysteradenectomy	4
Excision of fecal fistula	1
Opening and tamponade of caseous abscess	1
	38

Twenty-eight patients were cured 7 showed improvement in their condition and 3 died. The authors arrived at the following conclusions

1 The preoperative diagnosis of tuberculosis of the appendix is almost impossible. It can be suspected in cases in which there are manifestations of tuberculosis elsewhere

2 Primary tuberculous appendicitis is very rare

3 Secondary tuberculous appendicitis is more frequent than the primary type but is not as frequent as reported by other authors.

4 Simple appendectomy has shown good results in only 1 case did a fecal fistula develop. Among the cases secondary to ileocecal tuberculoma (4) there was 1 death due to intestinal obstruction. Of those secondary to adenexal conditions (4) there was 1

death due to general spread with tuberculous meningitis

As regards operative procedures the authors state the following

1 Simple inspection should be done in the presence of diffuse milium or nodular lesions of the peritoneum

2 Appendectomy should be done in cases in which the lesions are prevalent over the appendix and the remaining visceral and parietal peritoneum shows few tubercular nodules

3 Right hemicolectomy followed by ileotransverse colostomy should be done in cases of tuberculoma of the cecum

4 Appendectomy and hysteradenectomy are the proper procedures in cases in which the adnexal tubercular lesions are extending into the appendix

The authors believe that their favorable results indicate that the pessimism of other workers is excessive when they insist on the necessity of respecting the appendix in the removal of tuberculous lesions

LUCIAN J. FROMMELT, M.D.

**Sulfonamide Therapy and Abolition of Drainage in Perforative Appendicitis with Purulent Peritonitis (Sulfamidoterapia e abolizione del drenaggio nelle peritoniti purulente da appendicite perforativa)** PARIDE STEFANINI and PASQUALE FIGARA. *Ann. Ist. Osp. Aquilani* 1946-47 1:261

The literature is reviewed and reference is made to authors recommending drainage and nondrainage for perforative appendicitis with diffuse or localized peritonitis

The authors then record their experience with appendicitis. From April 1940 through the year 1945 200 cases of acute appendicitis with perforation 43 with diffuse peritonitis, and 157 with circumscribed peritonitis were seen. All these were treated by appendectomy and drainage with a rubber gauge drain. In 29 cases of the localized peritonitis group the appendix was not removed.

During 1946 the authors treated 11 cases of acute appendicitis with diffuse peritonitis and 36 with localized peritonitis following a standardized routine as much as possible. In this series of cases all patients with acute appendicitis were operated upon immediately regardless of the stage of the disease. Local anesthesia (20 cases) was the most common followed in order by ether anesthesia (13 cases) sodium pentothal anesthesia (12 cases) and spinal anesthesia (2 cases)

A McBurney incision was used in all cases. After the appendectomy was completed 5 gm. of sulfonamide were injected into the peritoneal cavity and spread with the fingers. At first powdered sulfadiazine was used, later crystalline sulfadiazine furnished by the Americans was used. This was followed by closure in layers without drainage

Postoperative care consisted of the intramuscular injection of 1 gm. of sulfadiazine every 3 hours or 8 gm. in 24 hours. In children the dose was reduced to 6 gm. a day or 1 gm. every 4 hours. This was con-



tinued until desferalence. The maximum total dosage was 36 gm. as a rule only 1 patient receiving 50 gm. and the average dose was from 20 to 24 gm. During the first days large doses of plasma and physiologic serum are used.

The postoperative course was much better than when drainage was used. There was 1 death among the cases of generalized peritonitis and no deaths among the localized cases. Complications were not frequent. Wound infections developed in 12 cases. There were 3 cases of pelvic abscess, 1 among the cases of generalized peritonitis in which case the only death resulted. There were no cases of obstruction as contrasted to 7 cases among the 200 patients treated with drainage. Other complications in the latter series with drainage were iliac abscess (1) subphrenic abscess (1) evisceration (1) pneumonia—fatal (2) pulmonary embolism—fatal (1) and phlebitis of the lower extremities ( ) none of these complications were seen among the cases without drainage. The average length of illness was reduced from 23.9 to 11 days for the patients with generalized peritonitis and from 21.17 to 9.6 days for those with localized peritonitis.

The authors conclude that the improvements in the second series were due to the abolition of drainage and secondarily to the use of sulfadiazine.

LOUISE J. FROST, M.D.

#### LIVER, GALL BLADDER, PANCREAS, AND SPLEEN

**Clinical Studies of Liver Function: The Hepatorenal Syndrome.** C. ROBERT SCHMIDT and V. E. CHERK. *Am J Surg* 94:8 75 772.

The present study was undertaken with the view of evaluating certain preoperative and postoperative therapeutic measures directed at improving the functional state of the liver in critically ill, poor risk, surgical patients. Because of the high incidence of associated renal and hepatic insufficiency (hepatorenal syndrome) following operation an evaluation of the role of the liver in postoperative morbidity and mortality must of necessity include serial studies of both renal and hepatic function.

Vital organs of which the liver and kidneys are examples are characterized physiologically by large functional reserves—large factors of safety. It has been estimated that but one-fourth of the parenchyma of these organs functioning normally is sufficient to carry out bodily functions. Decompensation follows when functional reserves are exhausted. Laboratory tests fall into two categories: function tests such as the hippuric acid and urea clearance tests, and decompensation tests, such as determinations of nitrogenous retention or the quantitation of icterus. The former give insight to the state of functional reserve. The latter give an idea of severity of parenchymal damage in an organ whose functional reserve has been depleted. There is no justification for the assumption that liver and kidney function are "normal" in a patient who is not jaundiced and

whose nonprotein nitrogen is within normal limits. This situation obtains not infrequently in patients who are without functional reserves and who are thrown immediately into decompensation by insult that would ordinarily be considered insignificant. Yet much of the present knowledge of the hepatorenal syndrome springs from such a premise.

Considerable supportive evidence of a postoperative liver kidney relationship is indirect. In many instances conclusions have been reached by a priori interpretation of hospital records and necropsy material. The functional state of the organs under indictment prior to the onset of pathologic decompensation was problematical or unknown. This is particularly true of kidney function. Bartlett has called attention to this shortcoming. Before postoperative renal insufficiency can be attributed to extrinsic origin appropriate tests which demonstrate previously existing normal renal reserve must be on record. There is a paucity of such data in hepatorenal literature.

The liver plays an important role in postoperative morbidity and mortality. Patients with evidence of subnormal liver function who responded poorly to specific measures directed at improving hepatic function were poorer surgical risks than those who responded favorably.

Patients who developed hepatic and renal insufficiency following surgery usually gave evidence of subnormal renal reserve prior to operation.

Diminished renal reserve plays a greater role in the development of the hepatorenal syndrome in surgical patients than is generally recognized. Knowledge of the blood nonprotein nitrogen is without information on renal reserve until such reserves have been depleted.

Transitory fall of blood pressure and anoxia in poor risk surgical patients should be anticipated during and after surgery. Preventive treatment is the most effective treatment of circulatory collapse.

Decholin sodium appears to have produced favorable results in the treatment of postoperative hepatic and renal insufficiency.

BENJAMIN GOLDMAN, M.D.

**Anoxia and the Liver with Special Reference to Shock and Chronic Malnutrition.** J. GILLMAN and T. GILLMAN. *S. Af J M Sc* 94:8, 13.

The authors have made a very detailed and important study of the fat and glycogen-free vacuoles found in liver cells under certain conditions. Acute anoxia from any cause results in the appearance of these vacuolated cells in the liver within a few minutes of the onset of the anoxic state, the vacuolated cells are the morphological expression of a disturbance of liver metabolism due to anoxia or shock of any cause. This serves to emphasize the importance of the liver in the shock syndrome.

Reports from the literature are cited to show that in hemorrhagic hypotension and shock, the portal blood flow through the liver is profoundly depressed and this depression may be out of proportion to the

changes in the peripheral blood pressure. In one reported experiment, when the blood pressure was reduced to 30 mm. following hemorrhage 11 of 12 dogs survived after viviparation of the liver via the splenic vein while 15 of 17 dogs treated the same way except that blood entered the jugular vein in stead of the splenic vein died after transfusion.

The authors found that the most potent stimulus for the formation of vacuolated cells in the liver was hemorrhage resulting in shock. However, similar vacuolated cells are found in other organs in acute anoxia and shock, the endocrines, striated muscles, heart muscle and brain may be similarly affected. Thus disturbances in functions of many parts of the body are all involved in the shock syndrome.

F J LEESEMAN JR. M D

**The Differential Diagnosis of Jaundice.** S ALLEN WILKINSON *Surg Clin N America*, 1948, 23 575.

In a particular case of jaundice the differentiation as to the type will usually be obvious from the history alone. There will be rare occasions when it will be impossible to decide whether or not there are enough features of obstruction to make it a surgical problem. In such cases it is better to operate than to temporize and usually a combined form of jaundice will be found.

The differentiation of hemolytic jaundice from the hepatogenous type is not difficult. The finding of a known toxic agent, the presence of an increased amount of bile and urobilinogen in the stools and of an increased amount of urobilinogen in the urine plus the absence of bile in the urine and normal liver function tests will usually make the diagnosis of hemolytic jaundice evident.

It is well known that there is no liver function test or group of tests that completely delineates the function of a liver.

The serum bilirubin determination is probably the most useful liver function test. The "one minute bilirubin" is said to measure the sodium bilirubinate present (the direct reaction) while the total bilirubin is an index of the sodium bilirubinate plus the bilirubin in the blood. Thus, the one minute bilirubin will be low or absent in hemolytic or retention jaundice because most of the bilirubin present is in the form of bilirubinogen. In severe hepatocellular jaundice or in obstructive jaundice the direct or one minute reading will be high as it will show most of the total bilirubin present.

The urobilinogen determinations are important helpful in differentiation and not difficult. Urobilinogen is formed almost exclusively in the intestine from bile reaching the intestine by way of the common bile duct. This intestinal urobilinogen is partly reabsorbed by the portal circulation, returned to the liver, and used by the latter in protein synthesis. If the liver is damaged much of the urobilinogen is passed on to the kidney where it is excreted. Hence an increase in fecal urobilinogen occurs in hemolytic jaundice, and an increase in urine urobilinogen occurs in most cases of liver damage and particularly in

TABLE L.—TESTS FOR JAUNDICE

Test	Retention Jaundice		Reperitization Jaundice	Normal Values
	Hemolytic Jaundice	Hepatocellular Jaundice	Obstructive Jaundice	
Bilirubin	1 min. (0.5) low Total-high to 5 mgm. %	1 min. (1) high Total-high to 5 mgm. %	min High Total-high 7 to 10 mgm. %	1 min. to 5 mgm. Total-0 to 5 mgm.
Urobilinogen Feces	High	Normal or low	Absent	1 to 4 gm. per day
Urine	Slightly elevated	High	Absent	1 to 20 or less
Serum protein Albumin-globulin ratio	Normal or low Normal	High Reversed	Normal Normal	5 to 7 gm. % 3 to 4 gm. % 1 to 1 gm. %
Bromsulphalein, 5 mgm. per kilogram dose.	Normal	Dysretention	Dy retention	0% in 45 min.
Cephalin flocculation	Normal	Positive	Normal (Any of these can become abnormal after liver damage occurs)	to plus (+)
Thymol turbidity	Normal	Positive		to 3 units
Thymol flocculation	Normal	Positive		0 to plus (+)
Cholesterol	Normal	Normal or low	Elevated	50 to 80 mgm. %
Cholesterol ester	Normal	Low	Normal	60% of total

portal cirrhosis. No urobilinogen will be found in the feces or urine if obstructive jaundice is present.

The tests based on serum colloids and electrolytes are not yet well understood. There has been a great deal written about the application and comparative value of the Takata Ara test, the cephalin-cholesterol flocculation test, the thymol turbidity test, the thymol flocculation test and the colloidal gold test. No one as yet has satisfactorily explained just what it is that these tests measure. On the other hand, everyone is agreed that they are very valuable tests and that they are among the most delicate and most reliable tests of liver dysfunction; however, no one of these tests covers all the various types of liver dysfunction. For this reason it is customary to order more than one on the basis that if they are all normal, the chances are very good that the liver function is normal. These tests offer a valuable check on the progress of liver disease and when they show a final return to normal we have the best evidence that the pathologic process has finally subsided. They do not offer any differentiation between intrahepatic and obstructive jaundice but they are likely to be normal in hemolytic jaundice. In early obstructive jaundice they will also show normal findings but these will change quickly as damage to the liver occurs consequent to back pressure in the biliary tree.

The serum cholesterol value combined with a cholesterol ester determination is sometimes of definite value. In obstructive jaundice the total cholesterol is increased. In hepatocellular jaundice, first the esters and later the total cholesterol may be much decreased. In fatal cases they will fall almost to zero.

CAR. O. LATIMER, M.D.

**Studies on the Pressures within the Common Bile Duct. Postoperative Cholangiomanometria (Estudios sobre la presión intracolestociana. Colangiomanometria pos-operatoria).** REMO B. FERRACANI. *Cirugía* 947 37.

The author who has been working on pressures in the bile passages under the direction of Adrián J. Bengole since 1938, uses a water manometer connected up with a Kehr tube or a Pitzer sound. This tube is attached to a apparatus making permanent graphs on a chart graduated in centimeters. The normal figures for pressure oscillate between 0 and 6 to 8 cm. of water, the values undergoing transient physiologic variations.

Under pathologic conditions such as residual lithiasis in the common bile duct, pancreatitis, or even a spasm of the sphincter of Oddi the biliary pressure tends to remain elevated for prolonged periods and may be accompanied by symptoms of biliary colic. The spasmodic or other occlusive condition may also be demonstrated by injecting colored fluids and observing the delay in their elimination into the duodenum by means of aspiration through the duodenal tube. The hypertensive condition tends to be relieved by injections of atropin or the administration of amyl nitrite and induced or intensified by the administration of morphine, eserine or pilocarpin.

The author concludes that the measuring of the intrabiliary pressures constitutes a valuable method for the study of the function of the terminal portion of the choledochus especially when accompanied by pressure perfusion and by concurrent cholangiographic studies.

JOHN W. BRENNAN, M.D.

**The Effect of the Ligation of the Pancreatic Ducts and of Pancreatectomy After Duct Ligation on Serum Lipase.** MARTI M. NOTEN, T. DEFRIN, PRATT and JOSEPH BENNETT. *J. Lab. Clin. Med.* 948, 33 833.

In an effort to establish experimental proof of the clinical value of the serum lipase test, the authors have repeated part of the work of Cherry and Crandell and have contrasted their results with the conflicting reports of Popper and Sorter.

An attempt is made to answer the questions: (1) Is there an increase in serum lipase after pancreatic duct ligation? (2) If there is an increase in serum lipase is it pancreatic or extrapancreatic in origin? (3) What is the mechanism of the increase of the serum lipase found in duct ligation?

The normal serum lipase values (olive oil-emulsion titration method) were established for 26 dogs. The average was found to be 0.6 units after ligation of

all pancreatic ducts, the 24 hour average was 5.1 units (a value 13 times normal). The 48 hour average was found to be 7.0 units and after 6 to 7 days there was a tendency for values to decrease. This seems to answer the first question and to prove that after ligation of the pancreatic ducts there is almost invariably a rapid rise of the serum lipase which lasts a relatively long time. Moreover complete pancreatectomy in 3 dogs resulted in an immediate decrease in lipase and eventual death. These data substantiate the idea that lipase originates in the pancreas.

The evidence for the extrapancreatic source of the lipase enzyme was the recurrence of normal serum lipase values in 2 to 3 weeks after total pancreatectomy in 2 dogs in which preliminary ligation of the pancreatic ducts had been done.

As to the mechanism of the increase, a pancreatic fistula was formed of a portion of the pancreas, the ducts of which had all been ligated. The previously elevated serum lipase values associated with ligating the ducts dropped to normal when the pancreatic secretion was liberated.

The authors conclude that the mechanism of elevated lipase levels in the blocking of the ducts (ligating) is due to absorption of the enzyme into the blood after ligation.

JANE C. MACFILLAN, M.D.

**Carcinoma of the Pancreas: Diagnostic Criteria.** GRAYSON F. DAINOFF and WALTER LINCOLN P. C. *MEER. Arch. Int.* 1948, 81: 173.

The preoperative diagnosis of carcinoma of the pancreas is still a difficult one, and the authors attempt to bring out diagnostic criteria that will aid in an earlier recognition of the disease.

The group here reported comprised 90 patients. The average age was 55.0 years and the sex ratio was 3 men to 1 woman. The chief complaint was pain followed in frequency by jaundice, loss of weight, anorexia, constipation, nausea and vomiting. The average duration of symptoms was 4.7 months.

The pain was gradual in onset and varied in location and quality but was usually steady. In many cases the pain was more severe when the patient was in the supine position. The most frequent sites of pain were the epigastrium, the upper abdominal quadrants, and the back. Jaundice was present in 66.6 per cent of the patients. As a rule the jaundice was pronounced and progressive, although in one case the jaundice did subside. Considerable loss of weight occurred in all cases. Twenty-four patients suffered nausea and vomiting and diarrhea was present in 18 patients. Steatorrhea was uncommon. The gall bladder was palpable in 58 per cent of the jaundiced patients. Glycosuria, usually in constant occurrence in 27 per cent of the cases, and a diabetic type of dextrose curve was found in 18 of 21 patients tested. The diagnostic value of this procedure may be greater than has been realized.

Röntgenologic examination may enhance the chance of a correct diagnosis. In this series evidence suggestive of the lesion was present in 35 of 79 pa-

twelve examined. The signs most commonly found were irregularities in the duodenal contour distortion and displacement of the stomach, deformities of the duodenal bulb and expansion of the duodenal loop. Lesions of the body and tail are less likely to produce roentgenographic signs than those of the head.

The authors comment on the importance of evaluating these signs and symptoms, and repeat the old injunction to keep the disease in mind.

ELY ELLIOTT LAZARUS, M D

**Surgical Conditions of the Spleen** FRANK H. LANEY  
*Surg Clin. N. America* 1948 28, 559.

After briefly considering what is known of the physiology of the spleen the author classifies the splenic states in which splenectomy is indicated and splenic states in which the indications are not all ways clear.

The splenic states in which splenectomy is indicated are as follows: rupture of the spleen, ptosis and torsion of the spleen, cysts of the spleen, tumors of the spleen, abscess of the spleen, malarial spleen, and when splenectomy is included in total gastrectomy.

The splenic states in which the indications for splenectomy are not always clear are as follows: familial hemolytic jaundice (hereditary), idiopathic thrombocytopenic purpura, splenic neutropenia, primary splenic panhematocytopenia, Banti's disease (with limitations), Gaucher's disease (selected cases) and Hodgkin's disease (selected cases).

Since the spleen rests directly over the upper surface of the kidney, one should never fail, should operation be undertaken for a ruptured spleen, to investigate the kidney, since any force capable of tearing off or rupturing the blood supply of the spleen must in its course also be delivered to the region of the left kidney and may also rupture this organ. Wide incision (the author uses a long left rectus incision) and good anesthesia, particularly the added relaxation obtained with curare, make it possible to control the hemorrhage and visualize the front surface of the kidney and the adrenal gland following removal of the spleen. Left nephrectomy may be done through the incision if necessary.

Ptosis and torsion of the spleen, cysts, abscesses and malarial spleen are uncommon lesions. Tumors exclusive of lymphomas are rare. Lymphosarcoma and Hodgkin's disease are the more frequently encountered tumors.

The author includes splenectomy in a great many if not the majority of the transthoracic resections for malignancy of the lower end of the esophagus or the upper end of the stomach. Also splenectomy is usually combined with total gastrectomies. The best way to add omentumectomy and total gastrectomy is to leave the spleen attached to the omentum to ligate the splenic vessels, to leave the vasa brevia running from the spleen to the stomach unsevered, thus there is complete removal of all of the greater omentum and with the stomach turned up it is possible to include also all of the gastrohepatic omentum with ligation of the gastric artery close to its origin. A review of the cases in which splenectomy has been included in these procedures has shown no bad effect on the blood picture.

Among the conditions in which the indications for splenectomy are not always clear congenital hemolytic jaundice stands out as the disease in which splenectomy is most consistently satisfactory. If the operation is not undertaken during an acute episode and if the gall bladder which contains stones is also removed, recovery from the anemia and relief from the jaundice occur usually without other treatment.

Idiopathic thrombocytopenic purpura is rarely associated with significant enlargement of the spleen and the spleen may actually be of less than normal size. So excellent and consistent are the results following splenectomy in this condition that when they are not good the correctness of the diagnosis is questionable. Once the diagnosis is established splenectomy should not be delayed.

Primary splenic neutropenia and primary panhematocytopenia respond satisfactorily to splenectomy. In those cases of panhematocytopenia in which the condition is secondary to other lesions the improvement will be definite but temporary.

While splenectomy in Banti's disease is not consistently followed by satisfactory results, splenectomy is indicated if the diagnosis can be made early, because of its propensity at least to decrease the load on the portal circulation and the possibility that it will defer or prevent the hemorrhages associated with esophageal varices and delay the development of portal cirrhosis.

The author has had one case of Gaucher's disease in which splenectomy was performed. The results have been quite good temporarily.

LARRY C. LATIMER, M D

# GYNECOLOGY

## UTERUS

**Uterine Cancer: Its Early Detection by Simple Screening Methods.** DANIEL J. McSWENNEY and DONALD G. McKAY. *N. England J. M.* 1948, 23:87.

For one year the authors have conducted a clinic for the early detection of cancer of the uterus at the Boston City Hospital. This "screening" process consists of a careful gynecological history with special attention to abnormal bleeding and vaginal discharges, a pelvic examination, a speculum examination and a vaginal smear. The last is most valuable as a test to determine cases that may require diagnostic curettage or cervical biopsy. Cases that are positive on smear or suspicious on smear history or pelvic examination are subjected to biopsy by curettage, cervical biopsy or both.

The technique and a brief description of the cellular characteristics are given.

The authors believe this method of screening is simple and efficient and definitely aids in the diagnosis of carcinoma. The degree of accuracy of course depends on the care with which the smears are taken and the training and experience of the cytologist.

Of 54 cases of cancer 51 were diagnosed correctly by smear.

Six cases of carcinoma, which might otherwise have been neglected were detected by the vaginal smear technique and 6 others were detected simultaneously by biopsy and smear. T. FLOYD BELL, M.D.

**Sarcoma of the Uterus.** THOMAS PERRY JR. *N. England J. M.* 1948, 23:703.

The author reports 4 cases of sarcoma of the uterus in detail. These are part of a group of 18 cases seen during the past 18 years at the Rhode Island State Hospital, Providence.

In a review of the subject of uterine sarcoma, it is pointed out that sarcomas may arise both in the smooth muscle of the uterus and in the stromal cells of the mucosa. The author also emphasizes that all reports show a preponderance of leiomyosarcomas over other forms of uterine sarcoma. The stromal or mucosal cell cancers of the endometrium are characterized by round cells rather than by spindle cells as found in typical leiomyosarcoma. The author also includes in this group the various types of mixed tumors which, despite their pleomorphism, presumably arise from stromal cells or their anlage. There are in this group mixed mesodermal tumors which contain more than one type of tissue of mesodermal origin. There are those which contain tissue of mesodermal origin and epithelium and are referred to as carcinosarcomas. A large proportion of stromal cell tumors, if carefully examined, show a mixed histology. All these sarcomas tend to contain giant cells.

Hemangiosarcoma and botryoid sarcoma are rare types. The botryoid type is most frequently seen in

the cervical portio of infancy, and presents a mixed histological pattern which includes epithelioid myxomatous tissue, striated muscle and other elements.

Most patients with uterine sarcoma have advanced disease after the onset of symptoms and radiation therapy invariably is useless. The author found that in the study of his group of patients there was a direct relationship between the number of mitotic figures and the rapidity of growth. It was found that in the larger tumors the areas which were more anaplastic were larger. Total abdominal hysterectomy with bilateral salpingo-oophorectomy is the treatment of choice. The chief cause of the low survival rate is the silent nature of many of the tumors. None of these tumors seem to arise in the cervix. The author thinks that most of them are malignant from inception and rarely arise in myomas.

The botryoid type usually arise in the portio of the cervix and extend down into the vagina. Striated muscle fibers in this tumor are considered pathognomonic.

It was advanced by Wilms, in 1899, that the mixed sarcomas of the uterus originate in displaced myotome and sclerotome elements which are carried down by the wolffian ducts.

HENRY C. FALK, M.D.

**Additional Data in the Technique of Vaginal Hysterectomy.** N. BROOK HEARNY. *West. J. Surg.* 1948, 56: 377.

After briefly relating the history of vaginal hysterectomy the author presents his method of procedure.

Since the operation may be difficult with the ordinary instruments used in abdominal work, a list of more suitable armamentarium is given. Two assistants are required. The operation is described in detail.

Shock occurs only rarely and usually the loss of blood is small. The intravenous administration of saline and blood transfusions are not given routinely. Patients are urged to sit on the edge of the bed with the feet in a chair the day after the operation, and to sit out of bed the following day. They are allowed to go to the toilet with help and are dismissed from the hospital one week after operation.

T. FLOYD BELL, M.D.

## ADnexAL AND PERIUTERINE CONDITIONS

**The Characteristics in Hysterosalpingograms in Tuberculous Salpingitis and Endometritis.** K. C. CHAN. *Surg. Am. J. Obst.*, 1948, 35: 933.

Unique and fairly constant topographic characteristics are seen in the hysterosalpingograms in tuberculous salpingitis and endometritis. The salient features are summarized:

1. In the plain films made before the injection of contrast medium in 4 of 6 patients, opaque bodies

were seen in the pelvis. In 2 cases fibrocalcareous adhesions were visible.

3 The filling of the uterine organ and the tubes was rather tardy. In the filling no sign of contractions was apparent. When filled the cervical canal exhibited a fuzzy shadow which has been described as "manlike or feathered by various workers. The uterus appeared like a trumpet or a Voorhees balloon, and its borders were shaggy and jagged. Its fundic shadow was invariably convex, and its lateral contour likewise bulging. The tubes, if filled were filled in a jerky fragmentary fashion so that their entire contour appeared to be beaded, segmented, and fractured. They were stiff wiry thready and drooped downward like a filament. There was often an abrupt ending of the filling process. The fimbria were pouchlike, saccular and diverticular in shape.

3 The appearance of the entire contrast medium was uneven nonhomogenous and simulating for eign bodies.

4 The stationary manner or the lack of spread of the contrast medium in the free peritoneal cavity, and the frequent complete emptying of the filled tubes after 24 hours were quite characteristic.

3 The imperfect filling of the organs might mislead one to think of a hypoplastic or a malformed uterus.

The pathogenesis of these characteristics is discussed and an outline of the differential diagnosis by means of hysterosalpingograms in various diseases is presented.

The presentation does not mean that all cases of tuberculous salpingitis and endometritis would present all the characteristics in the hysterosalpingograms. Never should one entertain the idea that tuberculous salpingitis and endometritis can be diagnosed by means of roentgenograms alone.

JOHN R. WOLFF, M.D.

#### Ovarian Fibroma with Ascites and Hydrothorax.

NIC. CLEMETSON *Ada obst gyn scand.*, 1948, 28  
96

Meigs syndrome has been noted in patients with other ovarian growths than fibroma. Its occurrence is infrequent, and the majority of some 50 published cases are to be found in the American literature. Only about half of these tumors are complicated by ascites.

The ovarian fibromas which form parts of Meigs syndrome vary in size from orange sized to larger than a man's head. They are mostly unilateral. In shape they are round or oval. The surface is often crinkled white or whitish yellow in color in most cases smooth and mirrorlike. They are hard often with larger or smaller cavities.

Microscopically they are seen to consist of fibrous connective tissue with many collagen fibrils. The cavities are usually without epithelium.

The ascitic and pleural fluid which is usually found in large quantities is as a whole slightly turbid or of a yellow to reddish color, and contains varying numbers of mononuclear and red blood cells.

Most of the patients with Meigs syndrome whose cases have been reported were from 40 to 50 years of age.

The most frequent symptoms are those referable to the chest, such as shortness of breath, stitch in the side and cough. Next in frequency among the symptoms is enlargement of the abdomen.

Treatment consists in laparotomy and extirpation of the tumor.

As to the cause of ascites the theory now generally accepted is that the greatest part of the ascites is formed in the tumor itself on account of circulatory disturbances. The production of ascites is too great in proportion to the capacity of the draining apparatus.

With the support of Efskind's experimental investigations respecting absorption in the peritoneum of rabbits and on the assumption of similar conditions in man the author submits the hypothesis that the lymphogenous drainage of the ascites takes place preferentially through the right part of the diaphragm via subpleural lymph vessels to the anterior intercostal lymph glands and therefrom further over into the blood vascular system.

If outflow from the anterior intercostal lymph glands is impeded, lymphostasis will arise and result in hydrothorax, especially on the right side.

One case is presented. T. FLOYD BELL, M.D.

#### Six Cases of Primary Carcinoma of the Fallopian Tubes. LUDWIG A. EMOR. *West J Surg* 1948 56-534.

The author presents 6 cases of primary carcinoma of the fallopian tubes. There was a 0.3 per cent incidence of tubal carcinoma among 2,000 tubes removed from 2,000 patients.

It is observed that primary tubal cancer is not only insidious and vicious in its growth habits but most confusing in its symptomatic manifestations. Large and localized malignancies often remain asymptomatic. Commonly they are confused with ovarian malignancy. Some authors state that the diagnosis should be thought of when pelvic inflammatory disease occurs at an age when tubal infection is rare but malignancy common and there is a sudden appearance of profuse uterine discharge not explainable by cervical or uterine disease. The manifestation of repeated discharge as seen in hydrosalpinx profusus is not a common finding.

The author believes that the vaginal technique of examining vaginal discharge is more apt to facilitate recognition of all pelvic cancers. Hysterosalpingography is not safe.

All 6 patients observed were dead in 20 months. The gross and microscopic appearance of the malignant tubes removed conformed to that described by other observers with regard to types and cellular composition.

Primary cancer of the fallopian tubes remains grossly localized for a considerable length of time provided the fimbria closes before the disease spills into the pelvis. The well known resiliency of the tu

lial wall permits enormous extension before the muscular layers are invaded. Lymphatic extension probably occurs long before extension of the growth affects the tubal wall. The grading of tubal cancer is not wise because all grades may be found in the same tube. The grade of cellular differentiation in no way allows for prognostication. The treatment is surgical and as radical as possible.

HENRY C. F. LE, M.D.

**Normal and Cystic Structures of the Broad Ligament.** GEORGE H. GARDNER, R. R. GREENE, MD  
B. 31 PYCERAM 1m J Obsd 948 35 9 7

The literature on cysts of the broad ligament was reviewed in an attempt to find or to formulate an accurate classification of these structures. Because of the terminologic and histologic overlap and embryologic diversities encountered it was decided to study the embryonic development of broad ligament structures, the normal adult broad ligament, both in routine and in serial section and, finally, the abnormal broad ligament. That portion of the study having to do with the histogenesis of cysts of the broad ligament is presented. The embryology and the normal and abnormal structures of the adult broad ligament are given. A simple classification based on histogenesis is proposed.

The authors believe that much of the existing confusion in classifying normal and cystic structures of the broad ligament can be eliminated by discarding terms based on proper names and using those having histogenic significance.

Certain well developed structures derived from the embryonic mesonephros are present in the adult broad ligament and can be demonstrated in properly fixed, sectioned, and properly prepared tissues.

Mesonephric ducts, mesonephric tubules, and paramesonephric structures, as well as their respective cystic derivatives, have an individual and a characteristic histologic appearance each can be identified with ease.

It is possible to classify most cysts of the broad ligament on the basis of the character of their lining epithelium but it is impossible to classify them accurately on the basis of their location in the ligament.

JOHN R. WOLFF, M.D.

#### MISCELLANEOUS

**The Use of the Vaginal Specr in a Gynecologic Service.** LOCKE L. MACKENZIE, BEN R. WETTERER  
JOHN C. DUBOIS, and THEODORE NEUBAERTER.  
Am. J. Obs., 948, 35 8

At the New York Post-Graduate Medical School and Hospital New York, New York the vaginal

specr has become a distinct addition to the diagnostic resources. It is not suggested that it supplants the well established diagnostic methods such as physical examination, biopsy and biologic hormonal assays and tests, but vaginal smears are used in association with the others and a proper amount of credence is placed on the interpretation.

The technique is particularly useful in evaluating endocrine disorders in women. The diagnosis of malignancy of the female genitalia can be made in a high percentage of cases and the method should be more widely used for this purpose.

All efforts should be directed toward an attempt to establish a smear criterion of premalignant change.

JOHN R. WOLFF, M.D.

**Implantation of the Ureters into the Rectosigmoid in Case of Urethrovesicovaginal Fistula (L'impianto degli ureteri nel sigma-retto nelle fistole uretro-vesico-vaginali).** ANGELO DE PALO. Quad. clin. esod. gine. 947 2: 883.

The following indications for ureterovesicovaginal anastomosis are listed by the author in order of their importance and frequency: urethrovesicovaginal fistula; vesicovaginal fistula with extensive destruction of tissues; grave trauma of the urinary bladder; radical extirpation difficulties encountered in ureterocystostomy following an injury of the ureters during obstetrical or gynecologic operations. The last mentioned injury of the ureters occurs relatively frequently in the course of a total hysterectomy for cancer of the uterus or for an intraligamentary fibroma. Such an injury may also complicate removal of the adnexa, which following inflammatory processes form adhesions to the pelvic peritoneum.

In the case reported by the author a vesicovaginal fistula appeared in a woman aged 24 on the fourth day of the puerperium following a spontaneous, normal delivery at term.

The physical examination disclosed an extensive vesicovaginal fistula involving the trigonum, with nearly complete destruction of the urethra. An attempt to repair the urethra through the vaginal route, 9 months after the delivery, failed. Thirteen months later the physical examination showed a nearly complete destruction of the anterior vaginal wall without traces of the urethra.

The ureters were implanted into the rectosigmoid area according to a slightly modified Hinman's technique under spinal anesthesia. The operation was performed in 2 stages, 3 weeks apart, one ureter being implanted each time.

The immediate and late results, checked with descending pyelography, were excellent.

JOSEPH K. NARA, M.D.

# OBSTETRICS

## PREGNANCY AND ITS COMPLICATIONS

**Hemoconcentration in Obstetrics** (La hemoconcentración en obstetricia) LUIS TRINCE BROUSSE Y ORLANDO TRIVELLI ROCCHI *Bol Soc chilena obst gín* 1947 12 303

The author found from his experience in 450 examinations with the Wintrobe hematocrit in pregnancy and the puerperium that the blood concentration was about 40 which suggested that there is a condition of hydremia during the gravid state which varying with the individual is greater than that commonly encountered in nonpregnant women. However numerous factors have an influence on this condition of hydremia and the test is found to represent another aid in the clinical examination of the patient and a guide to diagnosis and therapy.

Perhaps the most important condition to be looked for is the blood concentration leading to shock which may be present preceding the operation or during dystocia in patients who have been subjected to a low fluid salt free diet such as is commonly prescribed for the edematous renal or cardiac conditions encountered during the period of pregnancy.

The preoperative determination of the erythrocyte volume is also very important since the blood concentration may already be high (preshock condition) because of prolonged labor or a low fluid diet and the extra load placed on the organism by the operation may produce an irreversible condition. In such a contingency the patient must be given fluids even during the postoperative period because the natural tendency toward a restricted regimen can easily eventuate in an unnoticed concentration which may lead to shock.

JOHN W BRENNAN M.D.

**Pernicious Anemia of Pregnancy and the Puerperium.** L. S. P. DAVIDSON, R. H. GIRDWOOD and J. R. CLARK *Brit M J.*, 1948 1 819

The authors state that Addisonian pernicious anemia is uncommon, but that pernicious anemia of pregnancy is rarer still. Of 521 cases of macrocytic anemia examined in the last 7 years, only 31 were associated with pregnancy and of these only 4 were seen since the introduction of folic acid. No reports have appeared in the British literature and only 4 cases have appeared in the American literature on the therapeutic value of folic acid in this type of megaloblastic anemia (3 by Spies in 1946 and 1 by Moore *et al* in 1945). Folic acid was given in all cases by the parenteral route and in all cases a satisfactory response was obtained.

In the present article the authors report 3 cases of pernicious anemia of pregnancy and 1 case of Addisonian pernicious anemia that relapsed as a result of pregnancy all of which responded to folic acid.

The works of Stevenson (1938), Callender (1944) and Davidson, Davis and Innes (1942) are cited

Davidson and Davis (1947) noted four points of particular importance in the diagnosis of pernicious anemia in pregnancy.

1 The demonstration of typical megaloblasts in the bone marrow since the peripheral blood picture may differ from that of Addisonian pernicious anemia, the color index may be below one and the M.C.V. within normal limits.

2 Although free hydrochloric acid is often present in the gastric juice in a number of cases, a histamine fast achlorhydria is found. Unless the effect of stopping liver therapy is observed for a period up to 2 years it is difficult to decide whether it is a case of pernicious anemia of pregnancy or Addisonian pernicious anemia complicated by pregnancy.

3 The response to parenteral liver therapy may be normal poor and delayed or absent.

4 Cases refractory to parenteral liver therapy will respond to oral treatment with proteolysed liver or to cooked liver (Fullerton 1943).

No adequate explanation for the development of pernicious anemia of pregnancy has been forthcoming. Possibly it is a failure of some intake factor from a failure of production of Castle's intrinsic factor or defective absorption from the alimentary tract.

The authors suggest folic acid as the treatment of choice because it can be administered by mouth and shows rapid hematological improvement. Since the treatment is limited to a few weeks the danger of producing subacute combined degeneration of the cord is greatly reduced as compared with Addisonian pernicious anemia. However they state further that time must elapse before it can be stated confidently that neurological features will not occur in patients with pernicious anemia receiving folic acid.

The authors also warn that many cases of pernicious anemia of pregnancy also suffer iron deficiency and this must be corrected accordingly.

BYRON F HEARST M.D.

**Leucemia and Pregnancy** JOHN A WILLIAMS *Am J Obst* 1948 55 967

The coexistence of leucemia and pregnancy is rare. A review of the literature together with 2 cases added in this report brings the total number of reported cases of pregnancy associated with leucemia to 90.

A case of chronic myelogenous leucemia complicated by pregnancy with the mother still living more than a year after delivery is presented.

A fatal case of acute monocytic leucemia complicating pregnancy with a discussion of autopsy findings is presented. No similar case has been found in the literature.

With critical review of the literature it is safe to conclude that pregnancy has little if any effect on the course of leucemia. Leucemia per se does not require any special obstetric management.



Premature labor has been seen in the majority of cases, but severe hemorrhage, postpartum or during delivery by any method has been uncommon—9 instances among 83 patients with 3 deaths.

JOHN R. WOLFE M.D.

**The Possible Significance of Arterial Visualization in the Diagnosis of Placenta Previa** LEO J. HARTWELL *Am. J. Obst.*, 94:5, 55:940.

Arteriography is a method by which the outline of arteries may be seen on x-ray plates following the injection of radiopaque substance. This procedure has been carried out on almost every organ and region of the body. It was conceived that by delaying the time of exposure following the injection of opaque solution into the aorta, the maternal circulation over the placental site might be visualized by roentgenography. This procedure was carried out on 63 women in the later stages of pregnancy. The technique is given detail.

All women in this series delivered without mishap and all babies were living and apparently unaffected. Mothers and infants were released from the hospital after the usual routine lying in period.

Two cases of bleeding were encountered, one at the thirty-first week of pregnancy and the other at the twenty-eighth week. Aortograms were performed on these patients with no ill effects. In both instances there was a question as to the cause of bleeding.

If the bleeding had been produced by the separation of a low-lying placenta, the attendant danger to the mother and baby would have been less than had it been produced by an abruptio placentae. Since the hemorrhage in both instances, was profuse and sudden in onset gradually subsiding, the aortograms proved very useful when making a decision as to treatment.

In considering whether the risks involved in aortography are worth while in comparison with the hazards of watchful expectancy, the author believes that the series is not large enough for him to come to a definite conclusion. It appears evident that the procedure is sound and that the failures have been the result of errors in technique rather than a lack of fundamental soundness. JOHN R. WOLFE M.D.

**Chorea Gravidarum: Review of the Recent Literature and Report of 5 Cases.** THOMAS W. MC ELLIM, SAM B. LOVELAND and HENRY W. WOLTMAN. *Am. J. Obst.* 94:5, 55:992.

Chorea gravidarum is an infrequent complication of pregnancy. However, though rarely observed it occasionally presents a grave problem.

Data from 13 American hospitals suggested a hospital incidence of 1 case per 3,500 obstetric admissions although this may be an exaggerated concept of the frequency of this complication, since of 170 obstetricians replying to their questionnaire 113 had never observed a case.

The average age of the patients was 24 years. Chorea associated with pregnancy was observed much more frequently in primigravida patients. An

illegitimacy rate of 17.2 per cent was observed. The authors commented on the rarity of this factor in the Negro race.

The well known syndrome consists chiefly of hypermotility and incoordination which is usually generalized. The movements usually cease during sleep. The patients are usually afebrile and when fever does occur it is of ominous significance. Hyperpyrexia can occur.

The most frequent complications were stated to be acute psychosis, acute endocarditis and rheumatic fever.

Authors whose articles were reviewed warned against the excessive use of depressant drugs. The prophylaxis of chorea gravidarum consists of proper prenatal care. The treatment consists of keeping the patient at rest in bed and the administration of sedatives. Emptying of the uterus should be considered if the patient's condition becomes progressively worse. Local anesthesia should be used whenever possible and a neurologist should always be consulted.

The authors found it impossible to draw any significant conclusions from the small series of 5 cases observed at the Mayo Clinic, which they presented. In all of these cases chorea began in the first half of pregnancy and lasted for periods varying from 2½ weeks to 5 months. All of the pregnancies were terminated spontaneously at term and 6 normal babies were born (1 twin pregnancy).

Only 1 patient, whose condition might have been described as moderately severe, required hospitalization while under their care.

No evidence to support a toxic etiology of this condition was present in this series, other than perhaps the nausea and vomiting mentioned in 2 cases. A rheumatic background was present in all of the cases. A past history of chorea was given in 3 cases and of rheumatic fever in 2 cases. Heart disease was present in 3 cases.

The recent literature concerning chorea gravidarum is considered. Reference is made to the toxic, allergic, rheumatic, infectious, and psychogenic hypotheses of origin of chorea gravidarum. The current status of authoritative obstetric opinion is reviewed. The case for a rheumatic etiology of this condition is further strengthened by the 5 case reports. A suggestion of psychogenic "color" was present in this series. Conservative methods of treatment and delivery were used in all cases. A successful outcome of the pregnancy occurred in all instances.

## LABOR AND ITS COMPLICATIONS

**The Duration of Labor: Mean, Median, and Mode.** TERRY BURRY *Am. J. Obst.*, 94:5, 55:846.

The figures cited in textbooks for the duration of labor are 18 hours in primigravidae and 12 hours in multiparas. These are mean or average values calculated simply by adding up the total hours occupied by all labors in a large series, and dividing by the number of labors. Although mean or average figures

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are often valuable, they may sometimes be very misleading and not truly representative. The incidence of prolonged labors tends to distort the actual average figure.

The median and modal durations of labor are more statistically significant than the mean or average and certainly more in keeping with the experience of obstetricians. In white primiparas, the median was found to be 13.04 hours, the median 10.59 hours and the mode 7 hours. In white multiparas the median was 8.15 hours, the median 6.21 hours and the mode 4 hours.

The average duration of labor is longer in negro than in white patients, because of the greater incidence of prolonged labor in the former. Recent improvements in obstetrical technique and prenatal care have significantly shortened the average duration of labor.

JOHN R. WOLFF M.D.

**The Treatment of Placenta Previa (Consideraciones sobre tratamiento de la placenta previa)** JORGE ROQUELLAND GONZALES. *Bol. Soc. chilena obst. gín.*, 1947 12 310.

In this dissertation (on the occasion of the author's enrollment as a member of the Chilean Obstetrical Society) the therapeutic implications gleaned from a statistical consideration of the results obtained in 493 cases of placenta previa in 41,693 births (0.96 per cent) at the Maternidad del Salvador in Santiago de Chile are discussed.

No decisive conclusions are drawn as to the benefits to be expected from the introduction of the sulfonamides and penicillin since the period of their usage has been so short, however a favorable effect has been noted not so much in regard to morbidity as to the incidence of more serious infections which endanger the life of the mother. In fact, during the recent years there has been only 1 death among the mothers with placenta previa and in this case the woman presented a hopeless condition of perfringens septicemia when received in the clinic.

The encouraging control of the infections fixes our attention on the manner of the infections nor can they be foretold with any certainty—other than that they will certainly occur—and the only prophylaxis at present seems to be the removal of the contents of the uterus with resort to all of the modern resources for combating the anemia and other complications.

Cesarean section seems to be the only definitive recourse for placenta previa centralis totalis and this operation is indicated as soon as the diagnosis of this condition is made. Delay to await a more secure viability of the fetus is not to be considered, especially at present when modern progress in pediatrics offers greater chances for the immature infant, because it endangers both the mother and child.

For the other forms of placenta previa, cesarean section may on occasion be avoided however even in these cases the more radical procedure may be amply justified. So many factors intervene in these

patients that it seems impossible to lay down definite rules for their treatment. The one invariable rule is that these patients should be in a hospital from the instant of the first bleeding until the child is delivered. Here the viability of the fetus may rate some consideration since the mortality rate among infants weighing less than 2,500 gm. is very high. Of 211 dead babies 134 weighed less than this amount.

During the discussion ROGELIO RODRIGUEZ B related the use of the forceps of Willett in some instances in which the bleeding had persisted after the rupture of the membranes in placenta previa centralis partialis.

HECTOR CABRERA does not agree with the author as to the technique of the cesarean section itself. The author reports the use of corporeal or segmental corporeal type of incision in 20 per cent of cases. Cabrera, on the other hand reports 213 operations done at the Maternidad of San Fco de Borja with only 2 corporeal incisions, and the only death from peritonitis occurred in one of the 2 patients with this incision. The low incisions frequently passed right through the areas of implantation of the placenta without detriment to either mother or child.

MANUEL MORENO states that it is not the type of placenta previa which is important but the quantity of blood lost and the grade of anemia produced. In this respect the determination of the hemoconcentration is important.

JOHN W. BRENNAN M.D.

**Spinal (Saddle Block) Anesthesia in Obstetrics.** G. J. ANDROS, WILLIAM J. DIECKMANN, P. OUDA, H. D. PRIDDLE, AND OTHERS. *Am. J. Obst.*, 1948 55 806.

This is the study of 719 cases of modified saddle block anesthesia carried out at the Chicago Lying In Hospital Chicago Illinois. The procedure has been found to be safe, simple and precise. The degree of success has been high. The rate of operative interference in delivery was not significantly increased. Complications attributable to the anesthetic procedure have not been a problem. The benefits to the fetus in early spontaneous respiration have been striking. There has been no increase in the fetal or maternal morbidity or mortality.

JOHN R. WOLFF M.D.

**PURPERPERIUM AND ITS COMPLICATIONS**

**Acute Purperperal Mastitis.** H. CLOWE HERSKETT, CHARLES G. FREUDENBERG, AND K. ELLEN HITE. *Am. J. Obst.*, 1948, 55 778.

Acute mastitis is a serious medical and psychological complication of the purperperium especially if suppuration occurs. Early treatment of the condition may often bring about subsidence without suppuration. Many reports indicate that penicillin will aid recovery. Somewhat different results observed at the Chicago Lying In Hospital Chicago Illinois have stimulated the present report.

Two hundred and ten patients having suppurative purperperal mastitis were observed. Suppuration was

observed in 6 of 33 consecutive patients with mastitis who were receiving penicillin therapy. Eleven strains of staphylococci isolated from the suppuration grew in the presence of penicillin.

After nursing the local use of ointment containing penicillin failed to affect the incidence of mastitis.

Nasopharyngeal cultures from mothers and babies were examined for the staphylococcus aureus. Twenty-one of 30 babies were found to harbor this organism during the first 30 days of life as did 20 of the 30 mothers. Ten of the strains were resistant to penicillin in vitro.

The present work indicates that infection of the breast may occur in lactating mothers from the patient herself or from the nursing infant. The importance of the nasopharynx has been stressed. The resistance of the organism to penicillin therapy is certainly a factor in the development of suppuration.

JOHN R. WOLFE, M.D.

### MISCELLANEOUS

#### Therapeutic Abortion: Medical Considerations.

HORACE M. KORN, *J Am M Ass* 948, 37, 333

This article concerns itself with heart disease as a complication of pregnancy. Hypertension of the regressive type is considered to be a definite contraindication to pregnancy. However, in the types of hypertensive diseases in which there is no progressive increase in the signs and symptoms, interruption is not necessarily indicated. A valvular heart disease can be successfully managed in some cases; the decision as to which patients can tolerate pregnancy being based upon the age of the patient, the amount of cardiac hypertrophy, the past or present congestive heart failure, and the mechanism of the heart beat. Cardiac hypertrophy should be considered evidence of severe damage and of much greater significance than the valvular lesion itself. Congestive heart failure of a progressive nature is considered to be a clear-cut indication for the interruption of pregnancy. If there has been a history of congestive heart failure in the past only with the most careful observation should the pregnancy be carried. Severe and intractable disturbances of the mechanism of the heart beat likewise may require therapeutic abortion as does the onset of acute rheumatic heart disease or subacute bacteriocarditis.

Following these two articles is a round table discussion at which a number of questions were an-

swered by the discussants. In general it was agreed that with nearly every disease individual attention should be given each patient and no over-all rule can be made to cover any disease. Both incest and rape were believed to be adequate causes for therapeutic abortion. The question of therapeutic abortion when the mother has had German measles early in pregnancy was raised. It was believed that there was insufficient evidence at this time to indicate interruption in all cases. Hyperthyroidism should be treated as if the patient were not pregnant. Recurrent toxemia of pregnancy likewise was not believed to be an indication for therapeutic abortion unless advanced cardiac or renal damage was present. In the presence of RHI incompatibility with repeated loss of the fetus, the discussants favor complete blood studies in an effort to determine whether or not the husband was heterozygous or homozygous. The question should then be referred to one of the experts on blood groups for determination as to whether or not interruption of pregnancy is advisable in that individual case. The discussion was summarized and the importance of careful medical care was stressed over that of therapeutic abortion not only because of the dangers of the latter but also because of the tremendous loss of fetal life.

JAMES J. DONNELLY, M.D.

#### Therapeutic Abortion: Surgical Considerations.

SAMUEL C. HARKY, *J Am M Ass* 948, 37, 333

This article is a portion of a round table discussion on the indications and problems associated with therapeutic abortion. Emergency operations, such as those for acute appendicitis and intestinal obstruction, should be performed immediately even if there is some risk of causing abortion. Other surgical problems, however, such as hemorrhoids and varicose veins, can be postponed until the pregnancy is terminated normally. Under no condition in either group is therapeutic abortion justifiable. In cancer of the breast there is no evidence to indicate that continuation of pregnancy will alter the growth behavior of the malignancy. Therefore the patient should be treated as if she were not pregnant and the pregnancy not disturbed. However, it would seem wise to let the patient not to undertake further pregnancies for at least 4 or 5 years, and preferably not at all, and not to attempt to nurse her infant with the remaining breast.

JAMES J. DONNELLY, M.D.

# GENITOURINARY SURGERY

## ADRENAL, KIDNEY AND URETER

Renal Infarction. FRANCIS C. REGAN and E. GRAYVILLE CHAFFETZ. *J. Urol.* Balt. 1948, 59: 981.

The author's purpose is to indicate the types of infarction which may be encountered and the immediate and remote effects on the anatomy and physiology of the kidney, to collect the reported cases to emphasize the essentials of clinical diagnosis both for acute and the terminal states of the disease and to suggest methods of proper management.

The literature on renal infarction may be divided into two large groups (1) reports based on clinical and autopsy findings and (2) those based on clinical findings plus urological examination. In the first group an analysis of cases reported showed that the diagnosis was suspected from the sudden onset of pain in the kidney area in cardiac patients. In majority the pain was steady and radiated to the side. The urine in these cases contained albumin and the sediment showed red cells in half of the instances. In most of these cases death occurred from anuria and cardiac failure. Group 2 represents reports of cases comprising 47 arterial, 20 venous and 3 traumatic infarctions. In the cases of arterial infarction pain began suddenly in the flank or blood vessels of the upper abdomen and persisted for 2 to 4 days. There was some disease of the heart or blood vessels in the majority of these cases. By intravenous pyelography in 10 cases and by indigo carmine in 10 the function of the involved kidneys was shown to be very poor or absent in all of the 20 cases required various lengths of time ranging from 1 to 4 months. In those instances in which retrograde pyelography was done it showed normal configuration of the ureters, pelvis calyces and ureter. In 19 cases the renal pelvis calyces and ureter 4 to 6 plus and red blood cells contained albumin 1 to 4 plus and not made present a detailed analysis of 20 cases of renal infarction in which complete urological study was carried out and 4 cases of infarction in 71 were in tances of arterial infarction most of which were sterile in later life and in others it was unilateral with varying degrees of extent. The state of the patient dependent upon the bilateral occurrence of the lesion and the function of the other kidney when but one kidney is involved.

The diagnosis of renal infarction is based on the history and onset of pain in the flank or upper abdomen (2) the demonstration of ureteric and renal pelvis calyces and ureter on the affected side (3) the degree of renal involvement in kidneys which

the presence of disease of the heart or blood vessels (5) the presence of albumin in abnormal amounts in the urine together with microscopic and occasional gross hematuria.

Diagnosis of renal infarction may be made in kidneys which were the seat of previous infarctions. It has been shown that cystic degeneration of old infarcts occurs and it is to be remembered that the characteristic end result of infarction is calyceal shrinkage. These observations may aid in the differential diagnosis of such cases in which acute infarction is present.

It appears to be a fact that total or near total loss of function in the affected kidney is a primary diagnostic symptom in involvement of renal tissue. The degree of involvement of renal tissue in a venous infarction is a much more serious disease than a septic arterial infarction. Clots are more often infected and the condition is either bilateral or apt to become so by extension of the original process of thrombosis. The clinical picture of renal infarction due to venous thrombosis in the following manner: (1) it is associated with septic states—pneumonia, enteritis, puerperal infection, pyelonephritis in most cases follows thrombophlebitis of the leg veins or venous thrombosis in the pelvis. (2) there is gross hematuria in most cases and occasionally peritoneal hemorrhage. (3) the grade pyelography usually shows deformity and complete filling of the pelvis and calyces. (4) the condition runs a progressive and septic course and most patients do not recover unless nephrectomy is done.

Traumatic infarction is much more rare than arterial and venous infarction only 3 cases being reported. One patient had pain in the flank and hematuria following an accident. The second showed absence of function by intravenous pyelography but retrograde pyelogram showed normal calyces, pelvis and ureter. The urine was clear except for large amounts of albumin. In the third case an autopsy was carried out.

In summary the author states that arterial, venous and traumatic infarctions of the kidneys are diagnostic and surgical entities each type manifesting certain characteristics from which a diagnosis may be made. Sterile arterial infarction is the most common. It seldom if ever requires surgery. Venous infarction is a serious condition. Its close association and origin with septic states and the almost invariably infected clots make surgery imperative when there is infection or injury to the vessels. Then depends largely on the location of the infarction. The most important in the kidney is complete or almost complete loss of function in almost irrespective of the degree of renal involvement in kidneys which

appear normal by pyelography. Detailed analysis of the collected and reported cases is presented.

ROBERT O. BRADLEY, M.D.

**Renal Tuberculosis.** JAMES C. MCCLELLAND, KENNETH H. DAVIS, AND ERIC MAMMO. *J. Urol.* Balt. 1945, 59, 795.

The authors have had an opportunity to supervise personally 400 cases of genitourinary tuberculosis. This article states briefly the clinical and pathological findings in the kidneys removed at operation together with those studied at autopsy. Nephrectomy was carried out in 57 of these patients whose symptoms varied, and the pyelographic changes varied from no change to marked cavitation of the parenchyma. Autopsy was done in 40 of these cases. The lesions varied from tiny ulceral cavernous lesions to complete autonephrectomy. Grouping together the surgical and autopsy specimens provided an opportunity to make gross and microscopic studies of 105 tuberculous kidneys.

In the review of the pathology the outstanding lesions seen were those of progressive tuberculous involvement and destruction of one or both kidneys. The lesions may be grouped into three main categories: (1) the early solitary or multiple caseous lesions; (2) intermediate ulcerocaseous lesions with single or multiple cavitation; and (3) the late tuberculous pyonephrosis. The entire series presented 3 autonephrectomies, 13 pyonephroses, 38 ulcerocaseous lesions with cavitation, 7 solitary or multiple caseous nodular lesions, 6 of the very early ulcerocaseous type of lesion without cavitation, and 3 cases of very early single caseous foci involving the tip of a single papilla.

This study revealed a composite picture of the course of renal tuberculosis from the tiny early caseous lesion through succeeding stages of progressive involvement and destruction of the kidney with cavitation going on to tuberculous pyonephrosis and ultimately, in some instances, terminating in autonephrectomy.

The authors believe that the initial lesions were of hematogenous origin and consisted of microscopic foci of typical tuberculous granulomatous cellular reaction. At that stage they probably presented no clinical or laboratory manifestations sufficient to attract the attention of the urologist. They progressed to a later stage with caseation and destruction of kidney parenchyma and the presence in the urine of pus cells and bacilli without attending clinical symptoms. It is conceivable that such early lesions might have healed by scar formation but the fate of the lesions in this series appears to have been one of progressive evolution to stages in which the possibility of healing did not exist. No healed tuberculous foci were demonstrated in the material examined, and in the final analysis, one must conclude that if healing does not take place during the initial cellular phase of the tuberculous process, the subsequent course will be that of progressive involvement of one or both kidneys to the state in which renal

function becomes grossly impaired, and results in a state of uremia and death.

Correlation of the clinical information given by symptoms, x-ray findings and the pathological picture revealed that the clinical findings could not be depended upon to give an accurate picture of the extent of the pathological process. Kidney function tests were made but were found to have little value either in revealing the extent of damage or life expectancy.

These sanatorium patients had routine cultures of their urines, which made it possible to discover renal tuberculosis in its early asymptomatic stage before the appearance of distressing tuberculous cystitis. In cases in which tubercle bacilli are demonstrated in the bladder urine by culture, complete urological studies are carried out including catheterization of the ureters and retrograde pyelography. If the ureteral specimen is positive and the pelvic outline shows cavitation, the kidney is removed even in the absence of bladder symptoms. If the pyelogram is normal a repeat cystoscopic examination is made and ureteral specimens are once more obtained for culture. If the second culture is positive for pus and acid fast bacilli, nephrectomy is recommended. It is believed that the patient is suffering from clinical renal tuberculosis with an ulcerative lesion in communication with the kidney pelvis in spite of the normal pyelogram. A tuberculous pyonephrosis is removed if it is causing fever even though there may be an earlier stage of tuberculosis in the opposite kidney. This is the only instance in which bilateral renal tuberculosis is treated by operation.

The authors conclude that there were no areas of healing found in the surgical and autopsy kidneys examined in this series, and that clinical renal tuberculosis is treated by nephrectomy as soon as a confirmed diagnosis is made, even before pyelographic evidence of a cavity is found and before bladder symptoms occur.

ROBERT O. BRADLEY, M.D.

**Aneurysm of the Renal Artery** (*Aneurisma de la arteria renal*). PEDRO MOREYRA BERRAN and ALBERTO HALLAC. *Rev. argent. urol.* 1947, 6, 88.

The authors' patient, a 15 year old girl, had always felt a certain amount of pain in the lumbar region. About a month previously the pain became worse and now radiated to the epigastric region. Upon examination the only findings were bad teeth and pain on pressure over the right ureter and kidney pelvis. The right kidney seemed to be enlarged and was somewhat sensitive to palpation. The retrograde pyelogram revealed a renal pelvis with an odd rectilinear medial border and absence of the middle calyx, this portion being represented by a small rounded protrusion on the shadow border. In the middle of the pelvic shadow was a light area of rounded contour and about the size of a walnut. The kidney was approached through the lumbar region and the walnut-sized aneurysmal mass was disclosed beneath the renal vein but on the anterior aspect of the renal pelvis. The mass was surrounded by numerous fine

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blood vessels. The kidney changed color with pressure on the aneurysmal mass and remount was audible when the pressure was released.

The kidney and aneurysm were removed en masse and histologic examination of the aneurysmal wall showed that all of the layers of the arterial wall were present but with atheromatous changes between the intima and media. There was also evidence in the kidney itself of nephritic changes, congestion and hemorrhagic suffusions.

This was the eighteenth instance of aneurysm of the renal artery reported in the world literature.

In the discussion GARCIA reported the case of a well digger whose first symptom was the typical syndrome of Bunderitz (pain, tumor, collapse). Despite attempts to improve his general condition with intravenous infusions the patient died. Autopsy disclosed an enormous hematoma originating in the rupture of an aneurysm of the renal artery. In this case there was present an extensive degenerative condition of the aorta and a large aneurysm of this vessel.

EXCISE related the personal observation of a caldion of the norta and a large aneurysm of this vessel. He related the personal observation of a patient who had an aneurysm of the renal artery in a patient who was suffering also from stone in the ureter for which the operation which uncovered the aneurysmal tumor was done.

In closing the discussion ALICORTA announced that Polivert Gorro expects to report a case of aneurysm of one branch of a double renal artery. In this case it was possible to ligate the arterial branch in two places, remove the aneurysm, and thus save the kidney. The result of the operation was doubly fortunate in that this was the only kidney present.

JOHN W. BRENNEMAN M D

**Renal Rickets and Polycystic Disease.** HERMAN L. KATZSCHNER. *J Urol* Balt., 1938, 50 773

The term renal rickets suggests the coexistence of renal disease and rickets changes. The underlying disease of this syndrome is in the kidneys. Changes may be primary, such as interstitial nephritis, pyelonephritis, congenital polycystic disease, or hypoplasia of the kidneys, or secondary, to lesions of the lower urinary tract such as congenital valvular stricture and stones which result in obstruction leading to bilateral hydronephrosis. As a result of these various lesions prolonged renal dysfunction is followed by rickets changes. The author presents a case history of a child who had bilateral polycystic disease of the kidneys which was followed over a period of 4 years from 1933 until the death of the child in 1939.

In 1935 a positive diagnosis of bilateral polycystic disease of the kidneys was made by exploration and biopsy. During the 3 years following biopsy and at the age of 3½ the child presented an extremely rachitic stature, was pale, had a rather large square head, sat in tailor fashion with the legs more or less bent and had a large stomach and small limbs. An extreme rachitic rosary was present and the ends of the long bones were typically large. There was a marked flar-

rison a groove. The kidneys were easily palpable. This patient had been getting 3 teaspoons of cod liver oil daily since he was 3 weeks of age, and in the opinion of Brennenman the picture was that of renal rickets. The child died at the age of 4 years and 2 months. The pathological diagnosis was polycystic kidneys with chronic hepatitis and edema of the liver. The autopsy was limited to the abdomen.

The pathological changes designated as renal rickets renal dwarfism and renal infantilism. Such a diversity of terms has been employed because a multiplicity of disorders has been found underlying the syndrome. Barber in 1920 was the first to give the most accurate description of this condition and he called attention to cases of interstitial nephritis in children associated with stunted growth, some of them with infantilism in all its characteristics and others merely with a marked degree of dwarfism and suggested the term renal dwarfism until a more suitable and pathogenetic of this syndrome are not yet explained by any one hypothesis and much confusion exists. The principal theories presented have been the so-called renal hyperparathyroid acidosis.

The renal theory accepts the kidneys as the primary site of involvement in renal rickets. It suggests that there is relative or absolute inability of the kidneys to excrete waste endogenous phosphates from the body, that such wastes are excreted through the intestinal mucosa instead of phosphates in the urine, that such a concentration of phosphates in the intestinal contents may interfere with the absorption of calcium, presumably through the formation of insoluble calcium phosphates. This would result in blockage of the absorption of calcium from the food and the child suffers a true calcium starvation with resulting bone changes. This theory explains the presence of dwarfism or retarded sexual development, nor does it account for the cases in which the presence of dwarfism is not pronounced.

The parathyroids have been suggested as being responsible for part of the pathological process because large parathyroids have been noted at post mortem in these patients. Because of the parathyroid relationship to the calcium metabolism and the fact that changes may occur secondary to renal disease there have been many attempts to explain the findings of renal rickets by hyperparathyroidism. It is no doubt that the parathyroids do play a part in this clinical syndrome which accounts for the various changes observed in the type of bone changes found but it is still difficult to evaluate their precise function in some cases a lesion in the pituitary gland is noted and it is thought that the clinical picture of this syndrome may be due to a pituitary-diencephalic lesion. Some of the characteristics of renal rickets the dwarfism, the infantilism, and the polyuria might be explained on the basis of a pituitary lesion.

inasmuch as both the growth-producing factors and the sex stimulating factors are centered in this gland. The proponents of this theory believe that pituitary dysfunction could cause the dwarfism and that secondly an autonomic center in the adjacent diaphragm could cause urinary tract abnormalities in which there was no mechanical block. This would allow the chemical imbalance of the calcium and phosphorus metabolisms to result finally in a secondary parathyroid hyperplasia. However, the author states that in the case presented, the primary lesion was in the kidney and the rickets did not develop until 3 1/2 years later.

There is at present a tendency to try to explain the syndrome on the basis of acidosis inasmuch as osseous lesions of a much milder type can almost regularly be found in adult cases of prolonged renal insufficiency. None of these theories in themselves will explain all the findings of this syndrome.

The disease occurs in childhood and early adulthood and both sexes are equally affected. The symptoms are failure to grow, bone deformity, enlargement of the epiphyses, the presence of Harrison's groove, rachitic rosary, difficulty in walking, increased weakness, polydipsia, polyuria, and symptoms of uremia, and evidence of delayed sexual development. Kidney function tests will show impairment of renal function. The blood phosphorus is nearly always elevated, which is believed to be due to the inability of the kidneys to secrete the waste endogenous phosphates. The blood calcium may be low, normal, or even increased. Most cases terminate in uremia. However, no cases are alike and

Howard stated: "This is a disease of contradictions."

ROBERT O. READER, M.D.

**Adenocarcinoma and Tuberculosis of the Same Kidney** HAROLD A. NEUBLING and WALTER WALTER. *J Urol* Balt 945 59. 2.

A review of the literature and especially of isolated cases presented since the last general review of the literature on the subject together with a summary of 7 cases of combined tuberculosis and hypernephroma of the same kidney is presented. All but one of the 7 patients whose cases are reported were males. The ages varied from 38 to 63 years; the average age being 50.1 years.

Surgical considerations and removal of the lesions presented primarily the same problems as those encountered in nephrectomy for hypernephroma or for tuberculosis depending on which disease the combination found in this series most nearly resembled. The incisions used were posterolumbar, because it has been the consensus at the Mayo Clinic that most tumors of the kidney are accessible by this approach as by the transperitoneal approach advocated by some authors for the removal of large renal tumors. The adequacy of the posterolumbar approach is illustrated by the relative ease with which the large tumor in 1 case was removed. This tumor was a cystic mass 24 by 16 by 6 cm. from which some 2,500 c.c. of fluid were aspirated by trocar.

Nephrectomy in all cases was carried out in the usual manner, the attempt being made to isolate and clamp the renal vein as early in the operative procedure as possible. When the lesion resembled a frankly tuberculous condition and there was concomitant ureteritis, partial ureterectomy also was done.

Pathologically the malignant processes were mostly of low grade (Broders' method) with a preponderance of grade 1 lesions. This range of grade is in keeping with the observations of McDonald and Priestley who showed that the majority of hypernephromas removed at the Clinic are of the lower grades (1 and 2) based on the Broders' method of classification.

The size of the tumors varied greatly from the smallest discrete hypernephroid lesion of 3 mm. to the largest tumor measuring 24 by 16 by 16 cm. in which the malignant process and the tuberculosis were intermingled indiscriminately.

It is also of interest to observe that most of the lesions contained discrete areas of hypernephroma in a tuberculous kidney or small portions of tuberculosis in a kidney mass composed chiefly of neoplastic tissue, and only in 1 case was there apparent intermingling of tuberculosis and carcinoma.

The length of survival of the patients after operation is in close agreement with the general prognostic tables suggested by McDonald and Priestley in respect to hypernephromas.

It is noted that the diagnosis is directly related to that portion of the combined disease which predominates. In no recorded instance has the complete diagnosis been made preoperatively.

The prognosis probably is no better for the combined disease than it is for hypernephroma alone.

**Ureterotuberculous Anastomosis (Ureterotuberculous Anastomosis)** E. CASTRO, A. B. ORTIZ, and J. P. TORRES. *Rev argent urol* 947 16-319.

Brief case summaries of 9 patients with vesicular blastoma are presented. The patients ranged in age from 43 to 68 years. The presenting symptoms included hematuria, pollakiuria, cystitis, and dysuria. Cystoscopic examination revealed varying degrees of bladder involvement. Bilateral ureterotuberculous anastomosis was performed as a single stage operation in 3 patients and as a two stage operation in 3. One patient the only operative mortality in the series died in surgical shock within 24 hours after the right ureter had been transplanted. Follow-up pyelograms taken from 2 to 11 months after operation on 4 of the patients showed unilateral or bilateral ureteropelvic dilatation or diminished or absent renal function.

Preoperative preparation of the patients began 4 days prior to operation with the administration of a purge. This was followed by daily cleansing enemas and a tablespoonful of mineral oil by mouth each evening at bedtime.

To effect sterilization of the bowel sulfasuridine or sulfaguanidine was given daily for 4 days prior to

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operation in a dosage of 0.25 gr. per kilogram of body weight, divided into 6 or 8 doses. A few minutes before the patient went to the operating room an enema of rivanol was given him and he was brought to the operating table with the rectal catheter *in situ*.

Except in cases in which contraindications existed spinal anesthesia was used.

Postoperative precautionary measures consisted of the maintenance of hydration and homeostasis and the administration of penicillin and sulfasuxidine for their combined effect upon the intestine and the urinary system.

In the immediate postoperative period great care was exercised to prevent paralytic ileus. For this purpose hypertonic saline solution was introduced into the intestine by way of the rectal catheter. The latter which was left *in situ* from immediately prior to operation also served the purpose of maintaining a ready exit for flatus and urine from the lower intestinal segment. Insistence was placed above all on the early passing of a Miller Abbott tube. This insured a more tranquil postoperative period, eliminated abdominal distention and prevented traction on the sutures.

The operative results are divided into three categories: immediate, intermediate and late. The immediate period encompassed the time from operation until the patient abandoned his bed; the intermediate from that time until a year after surgical intervention; and the late, after one year.

In the immediate period there were no accidents related to disruption of the anastomosis or the development of urinary or intestinal fistulas. Healing per primam was observed, but no peritoneal reactions were noted. Immediate proctitis was avoided by careful attention to the rectal tube which was kept *in situ* for 5 or 6 days and reinserted if symptoms of proctitis presented.

Other than proctitis there were no overt sequelae in the intermediate period. During this time emphasis was placed upon the patient's return to a normal social existence.

In the late period that is, later than a year after surgical intervention, the patients who had been followed up through the three periods began to feel the consequences of an unnatural function. Infection which possibly had been present but well tolerated before appeared as a crisis. Large dilatations of the ureters, pelvis and calyces, and rapid decadence of renal function occurred. Urinary systems which before had functioned perfectly began to show signs of loss of their secretory and excretory function.

HAROLD W. BISCOPPE, M.D.

## BLADDER, URETHRA AND PENIS

Construction of Terminal Urethra in Hypospadias.  
JOSEPH H. KIEFER, J. Urol., Balt. 1945, 59: 1166.

A procedure is presented in which the terminal portion of the reconstructed urethra is formed from a foreskin flap and brought through a tunnel to the

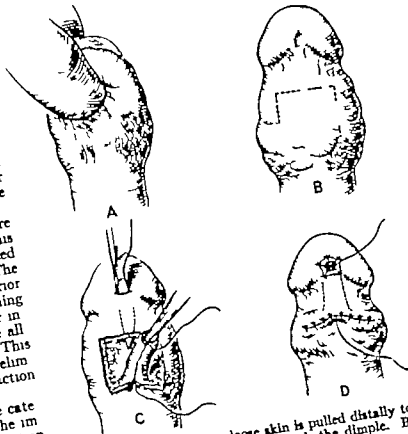


Fig. 1. A, Showing how loose skin is pulled distally to measure how much is needed to reach the dimple. B, Flap outlined. C, Flap formed into a tube and tunnel made. D, Tube drawn into place and sutured.

dimple in the glans. The penis is straightened after a complete encircling incision is made, as advocated by Nesbit. This usually provides considerable excess of skin on the ventral surface. The excess varies from 1 to 5, or more centimeters according to the amount of the urethral defect and the length of the foreskin. The amount of excess is measured by stretching the penis to its full length and measuring the amount that will be required to reach from the hypospadiac meatus to the dimple on the glans. The excess of skin which remains is measured and this measurement is the length of the tunnel.

A skin flap is constructed (Fig. 1). This flap must be the same width in millimeters as the caliber of the desired urethra in numbers of the French scale. The tunnel is made by incising the dimple through the tissue of the glans and continuing under the remaining skin (Fig. 2). Bleeding may be profuse at first but is easily controlled by pressure or the use of clotting agents such as thrombin solution. The flap which has been raised is then formed into a tube around a catheter by using a continuous subcuticular stainless steel suture. The tube so formed is then drawn through the tunnel and the edges are stitched to the adjacent edges of the glans at the dimple. The edges of the skin flap incision fall together quite naturally and are sutured with interrupted cotton or plastic silk-worm gut. The catheter is removed and



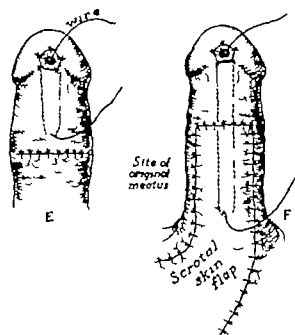


Fig. E, (Kleiser) Showing how a complete procedure may be done at one operation if the defect is not great. F. When the defect is large, the method may be combined with the Duplay procedure. Only the distal portion of the new urethra can be brought through the tunnel. The large bare area is covered by a scrotal skin flap.

a pressure dressing is applied. Usually at this time a pedicled flap is raised on the scrotum for use at the final stage. When this is healed the patient has the terminal 3 or more centimeters of his urethra, and the intervening segment is constructed at the final operation by the method of Duplay. The bare area is covered by a scrotal flap without any tension or superposition of suture lines.

The portion of the urethra so constructed can easily be sounded or dilated when necessary.

The advantages of the method are that healing of the terminal portion is excellent and breakdown unlikely. It gives a normal appearing penis with the meatus in its proper position. The functional result is also excellent as the stream is normal and does not spray.

FREEMAN A. LYON, M.D.

### GENITAL ORGANS

**The Prostatectomy of Terence Millin**—The Operation of the Future (Prostatectomie de Terence Millin, operation d'avenir) H. DUBREUIL. *Bardes* 1947 No. 3. 33.

The author mentions first the advantages and shortcomings of the perineal and suprapubic methods of prostatectomy. The perineal method as practiced in the United States and Germany is an anatomical operation with perfect hemostasis and with less shock than the method of Freyer. Nevertheless, it is a del-

icate and occasionally difficult operation with certain dangers to the rectum and the possibility of fistula formation.

The Freyer operation is simple and rapid but has the disadvantages of a transvesical approach with two wounds in the bladder. It proceeds in an infected medium, and is occasionally followed by shock and a painful postoperative course which requires close medical supervision.

There are two modifications of Freyer's operation, one by Fabre, with enucleation, complete hemostasis of the prostatic bed, and primary closure of the bladder with urethral catheter drainage. The other modification was made by Darget, with hemostasis secured by a balloon catheter and with perineal drainage and primary closure of the bladder. In contradistinction the operation (retropubic) by Terence Millin permits a direct approach by the shortest route without danger to the adjacent organs, such as the rectum and external sphincter and no opening of the bladder. Due to the advancement made with sulfonamides and antibiotics, the danger from cellulitis in the space of Retzius is minimal. Hemorrhage can be controlled by electrocoagulation.

The author has operated on 5 patients. 3 were completely cured on the sixth postoperative day. 2 had a fistula, one closing on the fourteenth day and 1 patient had complete retention of urine necessitating cystostomy. The author describes Millin's surgical procedure in detail with diagrammatic illustrations. The following highlights of his description are noted.

After the opening in the midline is made retropubically and a Harris automatic retractor is in place two pads support each side of the prostate and hemostasis is achieved by electrofulguration. The capsule is incised transversely. Hemorrhage is controlled by aspiration. Enucleation is started laterally with scissors and continued digitally. Sharp transection of the urethra at the prostatic apex precedes the enucleation and sharp transection at the vesical neck completes it. Hemostasis of the prostatic arteries at 5 and 7 o'clock is done by fulguration. The vesical neck is dilated with a spreader and wedge-shaped resection of the posterior lip. A Nelaton catheter with two eyes is inserted and the capsule is closed with interrupted sutures. Sulfanilamide powder is applied, and except for the drain the wound is completely closed. One hundred cubic centimeters of sterile water are injected into the bladder and bilateral vasectomy is done. No postoperative irrigation of the bladder is necessary. The catheter and drains are removed after 3 days.

The blood loss during the operations varies from 100 to 400 c.c. No postoperative hemorrhage was observed. The urine became clear in 24 hours. This perfect hemostasis does away with packing and postoperative pain.

The asepsis of the operation is important. The bladder itself is hardly opened because of the competence of the sphincter at the vesical neck. This is best demonstrated by the injection of 100 c.c. of

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water which are retained in the bladder. The post operative course is therefore afebrile. In cases with severe infections prior to operation a two-way continuous irrigation, sulfonamides and antibiotics will prepare a favorable field for intervention. The urinary stream flows through the natural route and therefore fistula formation is reduced as compared with other operations.

There is no shock and the operation can be executed within 20 to 30 minutes. The postoperative comfort of the patient is greater than that following other methods. From a practical consideration hospitalization is shortened to only about 12 days. Because of all the advantages the author believes that once an adenoma of the prostate is present this operation can be recommended to the patient prior to the onset of dysuria, polyuria, or the development of residual urine. This will lead to a broader indication and to early prostatectomy.

ERNEST BOSS, M.D.

**Rationale and Results in Retropubic Prostatectomy**  
OWSLEY GRANT and ROBERT LICE, JR. *Ann. Surg.* 1948 127 1010.

Three methods of prostatectomy have been recognized up to recent months. The suprapubic operation has the highest mortality; it is a blind procedure offers no positive hemostatic control and does not make possible the removal of an operable carcinoma. Transurethral resection is a procedure well adapted to small glands, median bars, and the inoperable obstruction of carcinoma. Prolonged pyuria, urethral stricture and inadequate resection are the unfavorable aspects of this operation. Perineal removal is a truly surgical operation which offers positive hemostasis, the ability to remove carcinomas radically, low morbidity and low shock. Fistulas and incontinence are the unpleasant sequelae. In the hands of the authors who have performed the largest series of retropubic prostatectomies in

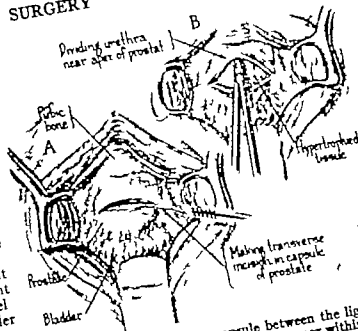


Fig. 2. A. Incision in the capsule between the ligated vessels. B. Division of the urethra at the apex within the prostatic capsule.

the United States this operation has proved to be the procedure of choice for the removal of large glands, both benign and malignant. The transverse glands both benign and malignant. The space and skin and fascial incision is preferred and the space of Retzius is swept clean of fat. The vessels in the prostatic sheath are sutured and divided and the prostatic capsule is incised transversely. A long pair of Mayo scissors is introduced into this wound and the adenoma loosened from its bed. The urethra is cut at the apex of the gland. The adenoma is then enucleated from the apex toward the bladder. When

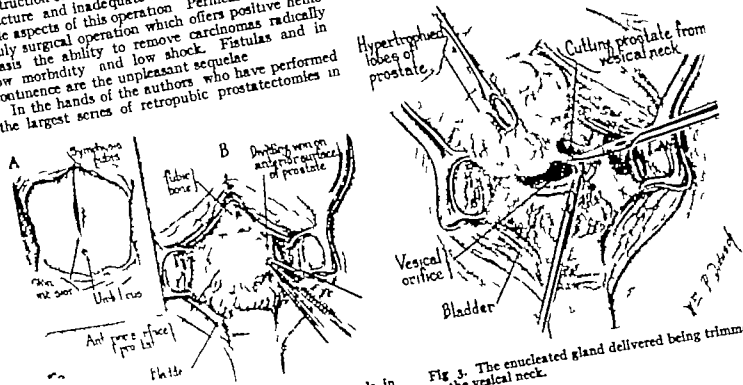


Fig. 3. The enucleated gland delivered being trimmed from the vesical neck.

Fig. 1. A. Skin incision. B. Exposure of vessels in adipose tissue covering the prostatic capsule.

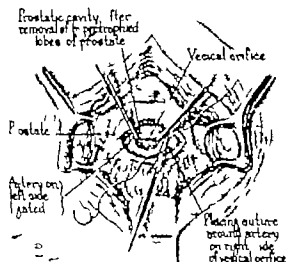


Fig. 4 (Grant and Lich) Ligation of the prostatic arteries

the coagulation has reached the vesical neck, the gland is lifted into the wound and the cuff of bladder attaching it is severed. The prostatic arteries are seen and sutured and any remaining bleeders are fulgurated. The bladder is explored with the finger for calculus or diverticuli. The prostatic fossa is inspected for nodules or tags. A catheter is then introduced into the bladder and the incision in the capsule is closed with a running suture. A rubber tissue drain is laid and the wound closed in the routine manner. The catheter and drain are usually removed on the third day.

In radical retropubic prostatectomy the steps are the same up to the point of incision into the capsule.

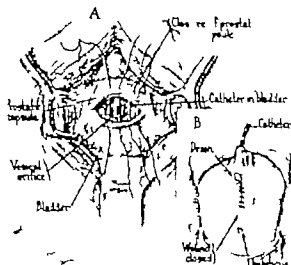


Fig. 5 A Closure of the prostatic capsule over retention catheter B, Skin closure with cigarette drain.

The puboprostatic ligaments are severed and the urethra is cut across. The gland with its intact capsule is then turned toward the bladder which causes separation from the rectum and allows the seminal vesicles to come into view. The gland is then cut free from the vesical neck, and the seminal vesicles are removed with the rest of the specimen. Anastomosis of the bladder neck to the cut stump of the urethra after hemostasis, completes the procedure.

The authors are well pleased with the results to date. Transfusion has seldom been necessary and there has been no case of incontinence or fistula. Most of the patients left the hospital on the eighth postoperative day. JOSEPH E. MAURER, M.D.

# SURGERY OF THE BONES, JOINTS, MUSCLES, TENDONS

## CONDITIONS OF THE BONES, JOINTS, MUSCLES TENDONS ETC

**Renal Osteodystrophy in the Adult** (Osteodistrofia renal en el adulto) JOSE VALLA, FRUTZ SCHAIOWICZ and CARLOS DELBOZ. *Rev orlop tranmal* B Air 1947 17 8.

Two cases of renal osteodystrophy are reported with a detailed analysis of the clinical symptoms course roentgenologic, histologic and chemical studies, bone involvement and anatomicopathologic examinations

Chronic renal insufficiency and uremia normal serum calcium hyperphosphatemia and acidosis were observed in both patients. The urinary calcium was low but the stool calcium was high. Osteitis fibrosa characterized the bony lesions of one patient with trabecular sclerosis not unlike Paget's disease, whereas the other case revealed only bony atrophy of the vertebrae and ulna.

Remission of the renal lesion was associated with a normal phosphatemia and increase of bone formations, but bony lesions, acidosis, and high calcium content in the stool followed long standing renal insufficiency

The relationship of parathyroid hyperplasia to the disease as found in the literature was discussed although the parathyroid glands in the 2 patients studied could not be examined. Other features of the disease as outlined in the literature were summarized

STEPHEN A ZIEGLER M D

**Osteoarthritis of the Cervicodorsal Spine (Radiculitis) Stimulating Coronary Artery Disease.** DAVIS and MAX RIVRO *N England J M* 1948 338 857

The authors analyze the clinical and roentgenologic findings in 43 patients complaining of attacks of substernal or precordial pain of nerve-root origin (radiculitis). The location character, and radiation of the pain closely simulated these findings in dis ease of the coronary artery.

The diagnosis of factors attacks of pain in bed two of the following factors attacks of pain in bed with change in body positions and on coughing sneezing or straining over the dorsal spine and attacks by pressure over the dorsal spine

striking response to orthopedic therapy In addition to the cervicodorsal spine, particular at radiculitis of the occurrence of a peculiar re tentation is called to the occurrence of a peculiar respiratory distress of radicular origin that may easily be mistaken for a manifestation of heart disease. The value of parasternal tenderness as a sign of dorsal root irritation is also emphasized

The patients in addition to irritation of the dorsal nerve root showed a high incidence of symptoms and signs of cervical radiculitis such as pain in the

shoulder girdle suboccipital headaches vertigo muscle spasm tenderness, and limitation of neck rotation

Roentgenological examination of the dorsal and cervical spine showed a high incidence of postural and osteoarthritic changes. The changes in the cervical spine may be summarized as follows disk narrowing 18 cases anterior osteophytes 39 cases posterior osteophytes 23 cases scoliosis 31 cases intervertebral joints 11 cases increased lordosis 5 cases straightening 23 cases osteoporosis 22 cases. In the kyphosis 1 case and osteoporosis in 7 cases dorsal spine there was disc narrowing in the anterior osteophytes in 39, posterior osteophytes in 4 and scoliosis in 30

The roentgenologic findings demonstrate the location nature and extent of the osteoarthritic changes in the spine and are of some value to the clinician when the symptoms are of short duration, the attacks cannot be reproduced or the radicular characteristics are not clear

The recognition of radiculitis and its differentiation from coronary disease of the artery are of practical importance in therapy and prognosis.

DANIEL H LEVINTHAL, M D

**Symmetrical Equal Bilateral Epiphyseal Separation of the Distal Radial Epiphysis** (Distacco bilaterale e simmetricamente uguale dell'epifisi radiale inferiore) PASQUALE FICARA *Ann Ist osp Aquilani* 1946-47 1 257

The author reports a single case of bilateral separation of the distal radial epiphysis which was probably unique because of the fact that the separation was of the same degree on both sides. Superimposition of the films showed the identical displacement. The patient was a boy 16 years of age, who while sawing a limb off a tree fell and struck both arms against the ground. Under local anesthesia the posterior radial displacement of the epiphyseal fragments was reduced and the arms were placed in circular plaster casts.

The author discusses the bibliography terminal ogy pathologic changes and treatment of this condition

CARLO SCUDERI M D

**Low Radiolunar Dyschondroplasia or Madelung's Disease** (Dischondroplasia radio-cubital inferior o enfermedad de Madelung) ALBERTO INCLAN COSTA *Cir orlop tranmal* Habana, 1946 13 68.

Three cases of Madelung's disease in which surgical procedure gave satisfactory results are presented. All the patients were young females, 2 of whom had serious endocrine imbalance. There was no history of infection or injury however 1 patient used considerable force while practicing on the piano. The pathogenesis suggests numerous theories such as the mechanical traumatic, muscular contraction

following infection endocrine and hereditary. Because the symptoms are more objective than subjective, and are insidious in character it is believed that the deformity is best studied by means of roentgenography.

Because of the progressive nature of the disease conservative methods of treatment are not satisfactory.

Surgical intervention consisted of corrective osteotomy of the radial incurvation, shortening of the ulna with raising of the head of the ulna, and transplantation of the bony fragments obtained to the lower and lateral portion of the osteotomized radius. A second surgical procedure has been required in these cases.

STEPHEN A. ZIEGLER, M.D.

**Osteochondritis Dissecans of the Hip (Osteochondritis dissecans de la cadera)** JOSE VALLE and DOMINGO T. MÓSCOLO. *Rev. chir. y traumat.* B. Alc., 947 7 47

The authors discuss 5 cases of osteochondritis dissecans of the hip. They believe that trauma has little to do with producing the lesions because they were unable to find in the literature any indisputable evidence of direct relationship. Furthermore, approximately 30 per cent of the cases are bilateral, and not infrequently Perthes disease coexists. Certainly none of the 5 patients was exposed to sufficient trauma to bring on the lesion.

Clinically the process may be confused with chronic rheumatism. There are no specific features of the disease. Most cases present a slow and painful course. Roentgen examination reveals the only distinctive characteristic the lesion being practically always found in the upper lateral portion of the head of the femur.

Treatment utilizes physical therapy immobilization simple sequestration arthroplasty and arthrodesis.

Three of the authors' patients were operated upon, the first developed arthritis deformans, the second recovered completely after 2 years, and the third has been operated upon too recently to permit appraisal of the results. A fourth patient, treated conservatively, is well after 7 1/2 years.

STEPHEN A. ZIEGLER, M.D.

**Popliteal Hygromas (Higromas Popliteos)** LKOROTI LUTS FERENOWICZ. *Cirurgia*, 947 4

The majority of tumors which develop in the popliteal space are hygromas of the serous sac of the semimembranosus and internal hamstring muscles (popliteal cysts, cysts of Baker). These tumors appear at the level of the crease behind the knee and, after they have expanded into the lower portion of the popliteal space, expand upward over the posterior area of the thigh.

These cysts are located medially and never in the midline a fact which distinguishes them from synovial herniations. Their surfaces are smooth and at times indented when they increase in size. They are tense and elastic.

The skin which covers these popliteal hygromas is not modified except in the presence of very large cysts in children when it becomes thin and transparent. The cysts are not painful and are usually found inadvertently by the patient or in the course of routine physical examination.

The differential diagnosis is between aneurysms of the popliteal vessels, lipomas, and synovial hernias.

The most important of these is the first and this is easily eliminated by the absence of palpable fremitus and bruit. By puncture of the cyst with a needle of large caliber a thick syrupy pale yellow liquid can be obtained. The use of a needle which is too small often leads to an erroneous conclusion.

Radiological examination of the knee is almost always negative. It is not rare however to see signs of arthritis in older patients. Filling of the cysts with iodolol or air will define the limits of the sac; however this is not necessary to establish the diagnosis.

The greatest incidence of popliteal hygromas is in males over 45 years of age and in boys less than 12 years of age. In the older age group there is a tendency of the cysts to appear abruptly.

Radical treatment consists of complete surgical excision of the hygroma. In older persons one may resort to palliative evacuation of the cyst by puncture and continuous application of a compression bandage. The use of injections of irritating liquids is contraindicated.

The incision of choice is transverse and is made at the equator of the tumefaction. When the development of the hygroma is such that it extends downward in the popliteal space the transverse incision is placed at the level of the interarticular line. The surgical draping of the leg should be so arranged that the leg may be flexed during operation without danger to asepsis.

Flexion of the extremity is necessary at certain times during the operation in order to relax the muscles and tendons which are at their maximum tension in the position of extension.

The anesthesia of choice is local.

After incision of the skin a small subcutaneous dissection is made to expose the aponeurotic plane clearly. An incision is then made in the fascia of the exact size of the skin incision, since it is this tense connective tissue which adds to the difficulties of exposure and dissection of the deepest portion of the hygroma. Upon sectioning the aponeurotic plane one will encounter the external saphenous vein at the medial end of the incision. This may be retracted medially if the hygroma is of moderate size, or sectioned between two ligatures if the hygroma is large.

Immediately beneath the aponeurotic plane one encounters the hygroma. Separation of the tumor is begun along the lateral border and continued at the inferior pole. After this the medial border is separated. Here the hygroma is intimately adherent to the tendon of the semimembranosus; however it may be separated by careful dissection.

In general when the cyst is dissected one observes that the wall of the tumor is adjacent to, and adheres

## SURGERY OF THE BONES JOINTS MUSCLES TENDONS

the facial planes and tendons is covered with soft tissue, and is easily separated from the muscular planes.

Almost invariably, upon separation of the contents from the covering of the medial hamstring tendons, it is opened. The opening and evacuation of the contents favor final dissection.

The separation of the cyst is continued superiorly and deeply, the operator being guided by the tendon of the semimembranosus and the tendinous aponeurotic fibers of the superior pole of the medial hamstring. Separation of the cyst at its uppermost border almost invariably leaves a small foramen in the synovial covering of the cartilage of the medial condyle of the femur. This does not signify pre-existence of a communicating foramen.

The operation is completed by careful suture of the fascial layer and skin. There are no special post-operative precautions.

HAROLD W. BISCOFF, M.D.

SURGERY OF THE BONES, JOINTS  
MUSCLES, TENDONS, ETC.

**The Bridging of Bone Defects.** A. GIBSON and B. LOANMAN. *J. Bone Surg.* 1948 30-A 381

The authors report the methods used and the results obtained in bone-grafting operations for defects and nonunion of the bones of the extremities on 105 patients at Deer Lodge Hospital, Winnipeg, Canada. All the patients operated upon were good surgical risks. In 85 per cent of the cases the injury was caused by a gunshot wound. Accidents of various types many involving motorcycles were responsible for the remainder. All but a few of the injuries occurred overseas and consequently there was an interval of several months between the time of injury and admission to the hospital.

Early in the series the cortical inlay or onlay graft with some cancellous bone from the upper end of the tibia, was used in almost every case. Later when more had been learned about iliac cancellous bone, this type of graft was used more frequently either by itself or in combination with other methods. The results obtained from the various methods are tabulated in the article.

Union occurred in 93 cases. Penicillin was used routinely after every operation and no graft was lost or failed to unite because of primary wound infection. In 84 patients, or 80 per cent of the cases, the first graft was successful. The cortical onlay graft was used 29 times in 27 patients and union resulted in 23 patients, or 79 per cent of the cases. The cortical inlay graft was used 27 times in 25 patients and was successful in 22, or 85 per cent of the cases. Cancellous bone alone was used 23 times in 23 cases to fill gaps, or to promote union in ununited fractures. Union occurred in 20 patients, or 87 per cent of the cases. Combined with a metal plate, it was used 23 times on 13 patients with union in 9, or 69 per cent of the cases. It was used 9 times in incomplete defects of the shaft of the long bones and fused

with the shaft in 7 patients or 78 per cent of the cases. In 12 cases cancellous bone alone was used to fill infected bone cavities with discharging sinuses. Wound healing occurred in 9 cases.

It was concluded that for ununited fractures, or for short gaps in the shaft of the radius, ulna, humerus, and femur the cortical onlay graft fixed with vitallium or stainless steel screws is the most efficient. Cancellous bone should be placed between the fragments and around the cortical graft. In the upper end of the shaft of the femur it should be combined with a metal plate or with a second onlay graft. In the ulna, if the size of the gap is 3.8 cm. or more, or if the fragments are difficult to control, a Lane plate used with the cortical onlay graft, may prevent absorption and fracture of the graft.

The sliding inlay cortical graft gives excellent results for ununited fractures, or defects of 5 cm. or less in the shaft of the tibia.

Cancellous bone alone will bridge a bone defect or promote union in ununited fractures in a high percentage of cases. However, before function can be allowed longer immobilization must be expected than if a cortical plate union may be slightly less certain but plaster immobilization is shorter. Its most practical use is in filling incomplete defects in the shafts of the long bones.

Infected bone cavities can be filled with cancellous bone and a high proportion of successful results can be anticipated if full thickness skin can be closed over the cavity and graft. This method may prove useful in the treatment of osteomyelitis of the tarsal bones.

RUDOLPH S. RUSICK, M.D.

## FRACTURES AND DISLOCATIONS

**Primary Closure of Compound Fracture Wounds. With Immediate Internal Fixation. Immediate Skin Graft, and Compression Dressings.** ARTHUR G. DAVIS. *J. Bone Surg.* 1948, 30-A 405

A review of 50 consecutive cases of compound fracture was presented in 1942, treatment of which consisted of immediate débridement, metallic internal fixation, skin grafting and compression dressings.

The present report is based upon a series of 150 consecutive cases of compound fracture observed during the 11 year period from 1936 through 1946. During the first 5 years when neither sulfonamides nor penicillin were available, 28 patients were treated. In the next 4 years 83 patients were treated with sulfonamides. In the final 2 years, 39 patients were treated parenterally with penicillin, in addition to the sulfonamide. A sulfonamide was dusted into the wound. During the last 5 years a blood bank has facilitated the generous use of transfusions and a high protein diet has been prescribed.

Except for modifications attending the advent of the newer bacteriostatic agents the blood bank, and the high protein diet the program of treatment described in 1942 has undergone no important change.

Greater experience, however, has taught the value of a more radical excision of questionable skin. With the adoption of this policy, it has been possible to reduce the incidence of sloughing of the wound edges and subsequent infection. Improved techniques in the transfer of split grafts, together with the use of the Padgett dermatome, have facilitated the grafting of large denuded areas.

Because of variables involved in the individual case, it is extremely difficult to evaluate the merits of any single approach to the treatment of compound fractures. It is sometimes impossible and frequently inadvisable to do combined immediate treatment of bony débridement, internal fixation, and closure. Six case reports are given in which different approaches have been used in accordance with the immediate requirements of the individual patients.

In respect to wound healing, bony union, prompt restoration of function, and the salvaging of extremities, the results have been superior to those obtained by previous methods. Improved results are attributed first to the compression dressing, second to immediate coverage of the surface defect with skin or split skin graft, and third to immediate or delayed terminal hairline reduction with metallic fixation when indicated.

The hazard of primary suture is greatly reduced by penicillin and the availability of whole blood. If done by first intention, it has been more frequent since the adoption of more radical excision of partly or wholly deitalized skin flaps. Temporary removal of the tourniquet has been found to be the only dependable aid in evaluating the vitality of the skin.

A thorough knowledge of and mastery in skin plastic surgery are important for selection of the optimum covering of the individual skin defect. Preference is given to the approximation of relaxed flaps whenever possible. Defects caused by relaxing incisions are covered immediately or later by split grafts.

Evaluation of the end results of compound fractures is facilitated by photographs of the external wound made at the time of the usual admission roentgenogram, and repeated 2 weeks later at the time of the first dressing.

An attempt has been made to evaluate the therapeutic indications in each case on admission and to determine the factors which require immediate treatment. Definitive fracture treatment should frequently be postponed. It is usually advantageous to carry out simultaneously the treatment of shock and careful débridement followed immediately by closure of the skin and the application of a compression dressing.

RUDOLPH S. REICH, M.D.

**The Management of Compound Dislocations.**  
JAMES K. STACE and PAUL MILLIGAN. *Q. Bull. Northwest Univ. M. School* 1948, 21, 66.

The authors have reviewed the literature of compound joint injuries and describe the method of

treatment of compound dislocations as exemplified in their 12 cases.

Compound injuries to joints are of course emergencies and treatment is carried out as early as possible in the operating room under general anesthesia and with a tourniquet. If a state of shock exists, the treatment for this may be carried out concurrently.

The wound and protruding bone ends are covered with sterile gauze. The skin area is shaved and thoroughly cleansed with soap and water and a skin antiseptic is applied up to the wound edge. The extremity is then draped and the wound débrided. It is usually necessary to enlarge the wound. Tissue into which dirt has been ground must be sacrificed, and it is the inadequate or timid performance of this step in the procedure which is the most common cause of subsequent sepsis. If the bone end is dirty, it is best to remove about one-eighth inch with a thin sharp osteotome. If dirt has been ground into the articular cartilage layer after layer should be shaved off with the scalpel until the uninvolved base is reached. Following this the wound is gently irrigated with saline solution and closed. It is essential that the joint be covered and thoroughly protected, even if fascia is required to make a water-tight compartment. Prior to closing of the skin, penicillin solution may be injected into the joint cavity. Wounds heal best if compression bandage is used and immobilization is usually obtained by means of a plaster cast.

VERNON C. TERVER, M.D.

**The Magnuson Stack Procedure for Recurrent Dislocations of the Shoulder.** N. J. GRANTHAM. *Surgery* 1948, 3, 704.

The theories in favor and against repair of recurrent dislocations of the shoulder are discussed. The Magnuson-Stack procedure is given in detail including the operation.

Thirty-one shoulders in 30 patients were operated on by the author. Sixty per cent showed evidence of avulsion of the capsule from the glenoid rim. There have been 2 recurrences to date.

At the time the article was written 27.6 per cent of the patients had definite limitation of external rotation. The remaining 72.4 per cent had a trace or no limitation of external rotation. Abduction was limited in 5 patients. Two patients showed a loss of forward extension. Eight patients reported the presence of pain. Seventy-seven and one-half per cent had painless shoulders.

This procedure was successful in 91.6 per cent of the patients in the present series of cases, with a minimum follow-up of 1½ years.

RICHARD J. BENNETT, JR., M.D.

**Mechanism of Fracture of the Carpal Scaphoid.**  
(Mecanismo de fractura del escafoides carpiano)  
HERNAN BAL-BAO. *Rev. ortop. tra. med.* R. A. M. 1947, 7, 66.

Direct trauma may produce fracture of the carpal scaphoid but this occurrence is apparently rare.

# SURGERY OF THE BONES JOINTS MUSCLES TENDONS ORTHOPEDICS IN GENERAL

direct blow over the anatomic snuff box area or anor surface of the wrist may result in fracture. However, this article is concerned chiefly with fractures occurring after indirect traumatization. The fracture occurs while the hand is in flexion or at a closed angulation or while the hand is in extension or at an opened angulation.

In the latter, the hand is in hyperextension as regards the semilunar bone and the first row of carpal bones, and the second row of bones is displaced posteriorly.

The indirect trauma includes (a) avulsion of the tuberosity by ligamentous strain (b) closure of the angle in the frontal or sagittal plane (in the author's opinion there is a closure of the frontal angle instead of the sagittal angle) (c) divergent compression or compression of the body of the navicular bone and (d) torsion (this is considered an original view) and the opening of the sagittal angle (this is the type of fracture that usually accompanies dislocation of the lunate).

STEPHEN A. ZIEGLER, M.D.

**Fatigue Fractures of the Fibula.** H. JACKSON BOW, *J Bone Surg* 1948 30-B 366

Fatigue fractures are spontaneous fractures of seemingly normal bone. They appear to result from a summation of stresses which singly are insufficient to produce fracture.

The author reviews the literature concerning fatigue fractures of the fibula and reports several personal cases. The fractures occurred 1 1/2 inches above the tip of the malleolus in the 5 women observed by the author and at a slightly higher level in 2 male patients.

Repetitious activity, movement in walking, running and skating produced the symptoms of pain, stiffness, localized tenderness and at times localized swelling. Sometimes there is slight redness and increased local cutaneous temperature. Limp and atrophy were rare. Few patients showed limited ankle and tarsal movement.

During the first 15 days or more there are no radiographic changes. In most cases but occasionally a fracture line may be evident after a week. At times there is a band of rarefaction. Callus may be observed at the end of a week in children and during the third week in adults. A dense band is often the first indication of the fracture site and almost always disappears. The diagnosis is congenital syphilis with osteomyelitis, tuberculosis, congenital syphilis, sarcoma and myositis ossificans.

The author recommends elimination of the exciting activity and the use of an elastic adhesive bandage with the aid of an elastic adhesive bandage from the metatarsal heads to the upper calf. Cases of "pseudo-fractures" in the upper third of the fibula have been reported by others usually occurring in soldiers, especially infants. Several cases of similar fractures in the middle third of the fibula have been reported. Fatigue fractures of the fibula may be unilateral.

**Acute Circulatory Failure in an Injured Limb.** L. GARRERAS, *J Bone Surg* 1948 30-B 380.

Sudden arrest of the circulation in a limb is a catastrophe of particular interest because apart from embolism and of arterial disease this emergency of fractures is most confined to the vascular complications of fractures and dislocations. Crushing injuries of a limb and accidents after the use and abuse of tourniquets are rare.

Ischemia threatening an injured limb gives rise to the syndrome of pain, pallor, paralysis and pulselessness. It is due to arterial injury by lacerations, compressions, intramural rupture or contusion or to arterial damage. The differentiation of spasm with out local injury from organic obstruction is not possible by clinical methods.

Unfortunately, complete arrest of the arterial circulation of an injured limb is seldom recognized until too late. Effective action is too often delayed. Vasodilator drugs have been disappointing. Eupaverine is probably useful. Papaverine is certainly still on trial. Tetrathyl ammonium bromide is still on trial. It promises well as a means of paralyzing the sympathetic but it has potential dangers. Heparin and other anticoagulants may be of great value and limit thrombosis. Alkalies are of great value and should always be given as a protection against renal failure. The only other useful drugs are morphine and other sedatives, which should be used freely.

The suggested plan of treatment and of management is:

1. General systemic investigation of the blood pressure, blood count and coagulation time
2. Removal of all external pressure
3. Resuscitation
4. A direct attempt to relieve the obstruction by operation
5. Postoperative care

The operative procedure recommended is:

1. Manipulative reduction of the fracture if possible
2. Proximal control of the artery
3. Arteriography
4. Exposure of the occluded artery (unless contraindicated by time factors and by the anatomy of the collateral circulation) liberation and mobilization of the vessel
5. Repair by suture when this is necessary and possible and arterectomy only if necessary

The provision of sympathetic block by injection or by sympathectomy is in addition to the alkalies penicillin should be given as a routine measure. The limb should be slung on some open form of splintage and kept cold. It should be slightly elevated and not compressed. The rest of the body should be heated. Smoking is prohibited but alcohol may be used.

DANIEL H. LEVINTHAL, M.D.



Acute Hematogenous Osteomyelitis. A Study of Treatment. WILLIAM NACHLAS and HERBERT R. MARKHEIM. *J Bone Surg.*, 1948, 30-A, 673.

Presently we are confronted with two diametrical-opposite forms of treatment for acute hematogenous osteomyelitis: first the systemic or antibiotic treatment and second, early surgical intervention with evacuation of the osteomyelitic abscess. Both treatments are good and have equal support from their advocates.

The present study was undertaken to determine the relative merits of emergency versus delayed surgical treatment and combined chemotherapy-antibiotic treatment. Based upon the roentgenographic evidence, local and constitutional manifestations, and blood cultures, 130 cases lend themselves suitable for this study. Seventy-eight of 130 patients were treated by emergency surgery, 33 by delayed surgery and 30 by chemotherapy.

For each of the above categories the authors sought a comparison relative to (1) mortality, (2) duration of disease, (3) recurrence, and (4) metastatic bone lesions. The mortality rate was as follows: emergency surgery 9 per cent, delayed surgery 3 per cent, chemotherapy none. Duration of the disease disclosed an average of 714 days for the emergency surgery, 360 days for the delayed surgically treated cases, and 169 days for the chemotherapy group. Recurrence, in the same order was 40 per cent, 33 per cent, and 10 per cent, respectively. Metastatic bone lesions occurred in 13, 28 and 10 per cent, respectively.

From the current investigation, the authors made the following observations:

1. The best results were obtained in patients treated via systemic approaches.

2. Delayed surgical treatment was not fraught with danger or increased morbidity.

3. The distribution of mortality was none among the systemically treated patients, 1 in the delayed surgery group and 7 in the emergency surgery group.

4. Early diagnosis and early antibiotic treatment should be established.

5. Surgical treatment of bone abscesses should be delayed and deferred when possible. Small osteomyelitic abscesses have the ability to absorb without surgical measures.

6. Chemotherapy and antibiotic therapy should be extended 2 weeks after the cessation of septic manifestations. Too early a withdrawal of these drugs has, in the hands of the authors, resulted in acute exacerbations of the disease.

Discussions by Phemister, Dickson Seddon, Farmer, Altemeier and Nachlas follow the article.

SAMUEL L. GOVERNAUX, M.D.

The Surgical Treatment of Intractable Plantar Warts. JAMES A. DICKSON. *J Bone Surg.* 1948, 30-A, 757.

Whereas 90 per cent of the plantar warts respond to a conservative regimen, the remaining 10 per cent require radical treatment. Verruca plantaris varies in depth, size and location. It may extend to the plantar fascia, tendon sheaths (with ulceration) and to the metatarsal heads, producing intractable pressure pain.

Undoubtedly some plantar ulcerations are produced by escharotics, x-rays, and electrocoagulative treatments. Such large ulcerating areas, obviously are not amenable to simple excision. Radical treatment, such as excision of the involved metatarsal head with its corresponding toe should be the treatment of choice.

In residual large plantar skin defects, the author recommends whole-thickness skin grafting, in addition to wedge-shaped excision of the skin and partial or total metatarsectomy.

Sesamoidectomy with removal of the warty area may be indicated in cases in which these bones are out of line and are producing the ulcerations.

Twenty-five patients have been operated upon by the author. This treatment is recommended only in resistant cases.

SAMUEL L. GOVERNAUX, M.D.

# SURGERY OF THE BLOOD AND LYMPH SYSTEMS

## BLOOD VESSELS

**Segmental Arterial Spasm Associated with Supracondylar Fracture of the Elbow: Report of a Case.** A. DALE COCKSILL. *Surg. Clin. A. America* 1948 28 467

Segmental arterial spasm described in the literature as arterial stupor, traumatic segmentary inhibition of the arteries, arterial contusion etc. is a relatively rare but serious condition in civilian practice. The physician must be alert to the diagnosis lest a salvageable limb be lost.

The case is reported of a supracondylar fracture of the elbow in an 8-year-old boy who 4 hours after closed reduction and Kirschner wire traction, maintained cold, discolored fingers. Eighteen hours later, in spite of repeated attempts to manipulate the fragment thought to be impinging on the brachial artery, the appearance had not changed. Operative exposure revealed a contused artery in marked spasm which did not lessen when the fragments were easily and exactly realigned. Dramatic improvement, however, was observed within 30 minutes following a 2 per cent procaine paravertebral sympathetic block. Twenty months after treatment the patient had an excellent anatomic and functional result.

Paravertebral sympathetic block should be employed early in the condition for its diagnostic and therapeutic actions for regardless of the disputed etiology of the condition, sympathetic paralysis constitutes the most rational means of attack. Periaxillary sympathectomy and resection of the involved segment of vessel are ineffective, sometimes difficult and of limited value. Operative intervention may often make a bad situation worse. Such a case in which open reduction was accomplished in the presence of marked vasospasm, is cited to illustrate that a limb may be lost under such circumstances.

ALLAN D. CALLOW, M.D.

**"Functional" Subclavian Arterial Murmur: Possible Relation to Scalenus Anticus Syndrome, Costoclavicular Compression, or the Neurovascular Syndrome of Wright.** JAMES D. MERRITT and R. BERNARD POMERANTZ. *Ann. Surg.* 1948 127 685-689

During the course of routine examination of 619 applicants for positions 21 patients came to attention because of a systolic murmur over the subclavian artery. The patients were predominantly young females who presented no abnormal findings on physical examination and had no symptoms.

The murmur occurred with greater frequency on the left side than on the right and was occasionally present on both sides. The murmur was loud and constant when the examination was performed while the patient's hands were held on the hips, was less frequently heard in the relaxed sitting position, and

was absent in the recumbent position. Abduction of the arms increased the intensity of the murmur up to abduction from 135 to 150 degrees when the murmur disappeared altogether because the blood flow to the arm as ascertained from the radial pulse and blood pressure had been obliterated.

When the murmur occurred on one side only it was noted that abduction of the arms caused a greater fall in the blood pressure in the arm on the side of the murmur than in the other arm.

The author believes that one case was due to costo-clavicular compression and the others probably represented the neurovascular syndrome of Wright.

THEODORE B. MASSELL, M.D.

**Portacaval Shunts in the Treatment of Portal Hypertension.** ROBERT R. LINTON. *J. England J. Med.* 1948 238 723

In the treatment of portal hypertension the most satisfactory portacaval shunt seems to be an end-to-side suture type of splenorenal anastomosis performed at the same operation at which the spleen is removed. Four cases of Banti's syndrome are presented in which various other types of procedures had previously been attempted without success. Three of the patients had splenectomies so that the splenic vein was no longer available for anastomosis.

Other types of portacaval shunt were performed such as anastomosis of the superior mesenteric vein to the inferior vena cava in one case and of the inferior mesenteric vein to the left ovarian vein in another case. Twenty-two and 14 months respectively have passed since the shunts were performed without evidence of esophagogastrintestinal hemorrhages.

The patient who was not splenectomized had been subjected to an extensive intraperitoneal omentopexy and ligation of the splenic artery. Despite the dense adhesions resulting from these procedures a successful splenorenal shunt was performed.

A direct portacaval anastomosis was not possible in 3 of these cases because of a cavernomatous transformation of the portal veins.

It is suggested that splenectomy should not be done for portal hypertension unless one is prepared to do a splenorenal anastomosis at the same operation, since this may be the only opportunity to construct a satisfactory shunt.

THEODORE B. MASSELL, M.D.

**Aneurysm of the Left Common Iliac Artery Secondary to a Traumatic Arteriovenous Fistula of the Left Popliteal Vessels.** J. M. DONALD. *Ann. Surg.* 1948 127 6.

The author introduces this case report because of the infrequency of accounts of an aneurysm developing proximal to an arteriovenous fistula. This patient suffered a bullet wound of the left popliteal

region 43 years previously and developed a pulsating mass in the popliteal region with swelling of the extremity. Varicosities developed and a subsequent ulcer which healed with difficulty. Pigmentary changes in the skin also occurred. More recently evidences of myocardial insufficiency were noted. In the past year a pulsating mass appeared in the left lower abdominal quadrant and became progressively larger. Examination revealed findings of an arteriovenous fistula in the left popliteal region, aneurysm of the left common iliac artery and cardiac enlargement with myocardial damage. The arteriovenous communication was excised by a double ligation proximal to the fistula and a quadruple ligation (anterior and posterior tibial vessels) distally. Eighteen months postoperatively the iliac aneurysm had decreased to one third of its original size and there was clinical evidence of myocardial disease.

In his discussion the author points out that proximal arterial dilatation occurs in the majority of long standing cases; this enlargement with the increase in blood flow is an effort to compensate for the relative ischemia existing distal to the fistula. The enlargement of the artery is directly proportional to (1) the size of the fistula, (2) the volume of blood short-circuited into the venous system at the fistula, and (3) the duration of the fistula.

Degenerative changes in the artery proximal to an arteriovenous fistula occur commonly and aneurysmal dilatations are thus a potential complication in all long-standing cases. The degree of improvement of such an aneurysm after elimination of the fistula will depend on the amount of damage which has already taken place in the artery and which may be irreversible. EDWARD H. CAMP, M.D.

#### Aneurysm following Surgical Procedures. DANIEL C. ELIOT. *J. N. Surg.* 64B, 776p.

The purpose of this article was to demonstrate the possibility of arterial injury in the course of operation eventuating in an aneurysm or arteriovenous fistula. From a review of the literature on this subject it seems evident that an arteriovenous communication may be produced in any operation but it is most likely that the lesion is produced when vessels are transfixed and ligated, an artery and vein being injured simultaneously by the needle and an opening made through which the communication is established. Care should be taken that no more than a single vessel be included in a transfusion suture.

In a personal series of approximately 650 operations for aneurysm and arteriovenous fistula, the author noted that 6 or approximately 1 per cent, of the cases followed some operative trauma. Five of

these cases are reported in detail: 3 being false aneurysms of the brachial artery, one following venepuncture and the other following incision and drainage of an abscess; 1 was a false aneurysm of the external iliac artery following herniorrhaphy; 1 was an arteriovenous fistula of the facial vessels following procaine injection for dental extraction; and 1 was an arteriovenous aneurysm of the renal pedicle following nephrectomy. EDWARD H. CAMP, M.D.

#### Local Heparin Treatment of Thrombosis following Arterial Resection. PERITI HOSKAYAN. *A. M. J. Surg.* 64B, 37-67.

Although heparin is generally considered to have no direct or indirect thrombolytic action, clinical experience (e.g. in thrombosis of the retinal vessels) has shown that small fairly fresh clots may dissolve under heparin treatment. This fact was further confirmed by experimental studies of mechanically induced thromboses of the jugular vein in rabbits.

The author reports a case in which there was simultaneous perforation of the ileum and rupture of the left common femoral artery as the result of external trauma. The intestine was repaired and an attempt was made to reconstruct the injured artery but a new thrombus immediately formed at the line of arterial suture.

Two and one-half cubic centimeters of heparin solution were injected directly into the thrombus, 0.5 c.c. was introduced into the external iliac artery and 2.5 c.c. were given intravenously after the completion of the operation. No subsequent injections of heparin were given because of persistent hemorrhage from the operative wound. After 24 hours the heparin effect had to be inactivated by a protamine sulfate injection and blood transfusion.

For the first 2 days after operation there was no pulsation in the femoral artery but on the morning of the third postoperative day strong pulsation was palpated in the femoral artery peripheral to the injury as far as the two arteries of the dorsum of the foot. The occlusion had thus dissolved before 48 hours had elapsed after heparinization.

The thrombolysis is attributed chiefly to the endothermic heparin since the freely circulating heparin was inactivated prior to the resolution of the thrombus. The author suggests that the lysis of large clots requires close contact of the heparin in high concentration with the thrombus. General heparinization fails to bring a sufficient concentration of the drug into contact with most of the clot but intrathrombotic injection seems to overcome that difficulty.

THEODORE B. MANGELL, M.D.

# SURGICAL TECHNIQUE

## OPERATIVE SURGERY AND TECHNIQUE POSTOPERATIVE TREATMENT

**Cardiac Resuscitation** ROBERT D. DRIPPS, CHARLES K. KIRBY, JULIAN JOHNSON and WILLIAM H. ERB  
*Ann. Surg.* 1948 127 592

Sudden cessation of cardiac activity is an emergency the recognition and treatment of which are poorly understood by many surgeons. Treatment must be boldly executed according to a carefully worked out plan consisting primarily of artificial respiration with 100 per cent oxygen and cardiac massage. The success or failure of such a program depends entirely on the length of time the brain is without blood supply. If restoration of the circulation occurs within 3 to 5 minutes, complete recovery can be expected, particularly in young, previously healthy individuals. Two problems demand attention: the heart must be restarted and the central nervous system must not be deprived of oxygenated blood for more than from 3 to 4 minutes. Cerebral anemia of greater duration is followed by widespread cerebral cortical destruction and death. The course of 4 patients on whom cardiac resuscitation was successful is described. Two of these patients suffered cerebral anemia for a period longer than 3 to 4 minutes.

When no peripheral pulse is palpable and blood pressure cannot be obtained by auscultation, three possibilities must be considered: (1) the heart has stopped beating entirely; (2) the ventricles are fibrillating; or (3) cardiac contractions are so feeble that insufficient blood is ejected to raise arterial pressure to the level at which a peripheral pulse can be felt.

The method of artificial respiration depends upon the circumstances. If cardiac arrest has occurred in the operating room, an anesthesia machine is satisfactory. Manual compression of the breathing bag will inflate the lungs and the elastic recoil of the respiratory organs completes the cycle. Although respiration (normal or artificial) can cause some blood to circulate, the most effective mechanism for movement of blood is the pumping action of a contracting heart.

A transverse incision in the fourth left intercostal space is best. The fourth and fifth ribs can readily be spread apart and the heart is grasped by the operator. Exposure may be increased by dividing the fourth and fifth costal cartilages. A direct approach through the chest wall is superior to an abdominal incision with an attempt to reach the heart through either an intact or an incised diaphragm. Opening of the pericardium is not required. The heart is compressed firmly at the rate of 20 to 40 times per minute, depending upon the adequacy with which the ventricles fill between compressions. Each compression raises the arterial pressure 60 to 70 mm Hg, and a pulse can often be felt in a peripheral vessel. To increase blood flow through the coronary

arteries the aorta may be occasionally compressed just above these vessels. Secretions which accumulate in the pharynx and tracheobronchial tree must be aspirated. Prophylactic injections of penicillin are often advisable to minimize pulmonary infection. The patient must be turned frequently from side to side to avoid hypostatic congestion in the dependent portions of the lungs. Urinary output must be maintained by an adequate fluid intake and constant attention must be paid to the bladder.

In general, if prompt diagnosis is followed by prompt therapy the heart can be started again. If on the other hand there is hesitancy rather than boldness, or if intravenous therapy is attempted before attention is directed towards the heart, the myocardium may have been sufficiently damaged by anoxia to resist all efforts at resuscitation. When the heart returns to a regular rhythm and blood pressure is maintained, spontaneous respiratory activity can be expected to reappear within 5 to 30 minutes.

C. FRED GOERTZNER, M.D.

**Skin Grafts. The Spiral Dressing** (Injertos de piel. El apósito espiral) HÉCTOR MARINO. *Rev. As. méd. argent.* 1947 61 463

The author proposes a practical way of immobilizing skin grafts laid on conical surfaces such as the segments of a limb, especially if different areas must be grafted in one sitting. In this particular instance, a compressive dressing alone cannot be used before the end of the procedure. In addition, it might wrinkle or displace the graft if it is not applied with exacting technique.

The spiral dressing consists of a cellophane or cotton ribbon or simply a No. 16 or 40 cotton thread wound around the limb, inclosing the graft. Once the graft has been stretched on the raw surface, with or without suture of the borders, the ribbon is applied with utmost care and very slight traction by the surgeon himself. The turns are made at a distance of more or less than 5 mm from each other and the graft thus remains attached to the surface under gentle pressure. Any excess of traction might bring circulatory troubles.

The ends can be knotted in a last circular turn or still better attached to the skin by a final stitch. The latter method avoids circular turns which easily produce impairment of the surface circulation.

Covering the limb with a coat of adhesive (masti sol) before winding the cotton tape around it helps to keep the turns in place.

It is important to remember that if an Esmarch bandage or the hemostatic cuff has been employed the restoration of the circulation is imperative before the spiral dressing is applied.

According to the author the spiral dressing has the following advantages over the plain or grease dressing.

1. It presents a quick and simple way of immobilizing grafts, allowing simultaneous operations on different sites of a limb.

2. As the graft remains perfectly attached the number of sutures can be greatly reduced.

3. The graft can be observed until the operation is finished and the final dressing is applied.

4. The outer dressing can be removed without danger of pulling off the graft which is caged under the ribbon turns.

5. Sutures can be removed and any sort of subcutaneous collections drained without disturbing the immobilization of the graft.

The use of the spiral dressing does not prevent correct postoperative immobilization with a compression bandage and, if necessary, a plaster cast. The author advocates the covering of the grafted area with sterile gauze, held in place with an elastic bandage and enclosure with a plaster cast. The elastic bandage is covered with a layer of crepe paper to facilitate the later removal of the cast.

#### ANTISEPTIC SURGERY TREATMENT OF WOUNDS AND INFECTIONS

**The Preparation of Granulating Wounds for Grafting (a Method)** JAMES T. MILLIS, JOHN B. PATTERSON, and R. EVANS HUNTER. *Plast. Reconstr. Surg.* 9:18 3 245

A large majority of the patients with burns who come to the surgeon are the ones who have survived the acute phase and have been referred because of full thickness skin loss of varying extent. Most of the wounds are grossly infected and covered with exuberant granulations.

When a case of this type is admitted to the hospital the usually malodorous ointment dressing is removed with aseptic technique, a wound culture and photograph are taken and laboratory work in the form of Kahn blood plasma protein and albumin and globulin tests, a complete blood count, urine analysis and blood typing is ordered. All crusts and necrotic tissue are then removed, the surrounding skin is washed and shaved, following which a single layer of nonoverlapping 4 by 4 mesh plain sterile gauze is applied over the granulating surface. This is followed by wet saline dressings. Evaporation and capillary contamination are minimized by wrapping the part in sterile cellophane or similar moisture-proof material. The saline dressings are then changed every 4 hours down to the fine mesh gauze by the nursing staff with sterile technique. The fine mesh gauze is usually left undisturbed for a week unless necrotic tissue is present, in which event it is changed every 2 days until all separating tissue has been removed.

During the interval the patient's temperature usually returns to normal, his appetite improves, and the blood picture is brought back to near normal by blood transfusions. By the third hospital day the admission wound culture report is available and if this reveals pathogenic gram positive cocci, penicillin

in the amount of from 5,000 to 15,000 units may be added to each ounce of saline solution used. If pathogenic gram negative bacilli are reported, from 0.1 to full strength soluble furacin solution may be used to advantage. However neither is recommended for routine use since adequate drainage of the granulating wound will usually permit the tissues themselves to either destroy or effectively reduce the bacterial flora.

On the seventh hospital day the patient is taken to surgery where under general anesthesia, the fine mesh gauze is removed, a check culture is taken, all exuberant granulations are cut down to a firm base, fresh sterile fine mesh gauze is applied in a single layer and the wet saline dressings every 4 hours are resumed. The check culture is usually either negative or the number of bacteria is appreciably reduced.

By the tenth hospital day the granulating bed is usually clean in appearance and ready for skin grafting. Under general anesthesia the recently applied fine mesh gauze is removed, the part covered with hot saline packs, and the grafts taken with a Padgett dermatome. These are then placed upon the granulating bed and fixed in position with sutures and a pressure dressing over fine mesh vaseline gauze. An attempt is made to cover the entire area in one operation if the wound is considered not too extensive, the skin is available, and the condition of the patient permits.

If however the area is too extensive such as two entire lower extremities one will be grafted and the other kept clean for covering at an early date. The intramuscular administration of penicillin in the amount of 50,000 units every 3 hours is started the day before surgery and continued until the first postoperative dressing on the third postoperative day. At the time of this dressing all sutures are removed, any blebs, pustules, or hematomas are incised or excised and any necrotic graft or over-lapping graft edges are excised. Fine mesh gauze is again applied in a single layer and wet saline pressure dressings are instituted. These are changed down to the fine mesh gauze every 12 hours and continued for from 4 to 7 days as the case may warrant. All dressings can be discontinued by the tenth postoperative day if the take is in the upper alveolae. Any remaining granulating areas may then be strapped with adhesive tape until epithelization is complete. If the area grafted is a lower extremity an elastic bandage must be worn until the graft has adjusted itself to dependent circulation.

The cause of any appreciable loss of the graft will usually be found to be due to infection, hematoma, improper pressure immobilization or both of the latter in that order.

The advantages of the fine mesh gauze treatment of granulating wounds are as follows:

1. A single nonoverlapping layer of fine mesh gauze allows the drainage of exudate through it into the overlying wet dressings, which in turn can be changed frequently and relatively painlessly.

2. Removal of the granulations prior to the day of skin grafting results in a cleaner wound and a more receptive bed and minimizes bleeding beneath the graft.

3. Changing the fine mesh gauze 2 or 3 days prior to grafting likewise minimizes the oozing from the granulating wound when the gauze is removed on the day that the grafts are placed.

4. Following the skin grafting the fine mesh gauze allows the spread of epithelium with a minimum of disturbance.

5. All dressings other than the initial one those in which the fine mesh gauze is changed and the initial dressing after skin grafting can be done by trained hospital personnel.

FRANK F. KANTHAK, M.D.

## ANESTHESIA

**Animal Experiments with Procaine and Related Drugs.** FREDERICK M. ALLEN and FRANK K. SAR FORD. *Current Res Anesth*, 1948, 27 131

These experiments deal with the clinical effects of the procaine class of drugs on animals chiefly rats. They concern mainly the systemic effects of injections into the tissues and thus are somewhat intermediate between the clinical methods of local infiltration and intravenous anesthesia.

The approximate toxic or lethal dosage of procaine in rats was ascertained in intravenous intraperitoneal, intramuscular and subcutaneous injections. Experiments were done to study the prevention of toxic or lethal effects by artificial slowing of the absorption. Epinephrine and local temperature reduction delayed absorption. The possible usefulness of colloid or lipid emulsions is undetermined. The availability of the tourniquet adds to the safety of large procaine injections in the limbs. The higher the poisonous dose the greater must be the number of alternate applications and releases of the constriction.

The effects of procaine overdosage in animals are dyspnea, convulsions and collapse and the reaction to painful stimuli are exaggerated. Therefore procaine alone is entirely unsuitable for systemic anesthesia in the common laboratory animals. It can reduce the dose and increase the efficiency of a barbiturate used for anesthesia, but the barbiturate must predominate and the procaine merely be a supplement. Analogues of procaine (intracaine, metacaine, pontocaine, nupercaine) were studied. They behaved similarly to procaine but were more toxic.

Sodium pentothal in 0.1 per cent concentration can be mixed with procaine without precipitation. The analogues of procaine are precipitated by pentothal in still weaker concentrations.

Pentothal sodium inhibited procaine convulsions in rats but did not counteract the lethal effects nor was procaine an antidote to lethal doses of pentothal. Some protection seems to be offered by nupercaine.

Local tissue necrosis complicates the effects of procaine injections in rats. Procaine appears to neither mitigate nor aggravate secondary shock. There is

evidence of great difference in the effects of procaine in animals and man. MARY KARP M.D.

**Regulation of Blood Pressure during Spinal Anesthesia: Observations on Intramuscular Pressure and Skin Temperature.** H. MILWIDSKY and A. DE VRIES. *Anesthesiology* 1948 9 353.

Among the theories advanced to explain the hypotension of spinal anesthesia, only two are supported by present-day investigators i.e. the theory of stagnation in the postarteriolar bed and the theory of arteriolar dilatation. This investigation has been carried out to acquire further information on the mechanism of blood pressure regulation during spinal anesthesia in the light of these theories.

Intramuscular pressure in the lower and upper extremities of 11 patients under spinal anesthesia was measured to investigate the possible correlation between skeletal muscle tone and blood pressure fall during spinal anesthesia. No significant decrease of intramuscular pressure developed in the paralyzed lower extremities. Thus it was felt that a decreased skeletal muscle tone cannot be the main cause of blood pressure fall in spinal anesthesia.

Skin temperature measurements were performed in the lower and upper extremities of 21 patients under spinal anesthesia to ascertain the role of vasodilation in producing hypotension and of compensatory vasoconstriction in preventing it during spinal anesthesia. The findings show a definite correlation between the degree of blood pressure drop and the upper level reached by the spinal anesthesia. The question why compensatory vasoconstriction occurs in some cases and not in others can now be answered.

Arteriolar dilatation resulting from vasoconstrictor paralysis in the anesthetized part of the body is the principal cause of blood pressure fall during spinal anesthesia. Compensatory vasoconstriction occurs in the area not under the effect of the anesthetic agent. The ratio between the area of vasodilation and that of compensatory vasoconstriction determines the degree of blood pressure drop in spinal anesthesia. In high spinal anesthesia the majority of vasoconstrictor fibers including those supplying the upper extremities (fourth to eighth thoracic) are blocked and hypotension ensues. In low spinal anesthesia a sufficient number of vasoconstrictor fibers are left intact to prevent a major drop in blood pressure. MARY FRANCES POE, M.D.

## SURGICAL INSTRUMENTS AND APPARATUS

**Auriculomastoid Tube Pedicle for Otoplasty.** DAN N. STEINMANN. *Plast Reconstr Surg* 1948 31 359

Restoration of auricular deformities taxes the ingenuity of the plastic surgeon. The complex topography of the auricle calls for the solution of three problems: whether the reconstruction is to be partial or total. First support must be supplied by autogenous or homogenous cartilage with duplication of near normal configuration. Second soft tissue covering must be obtained either from adjacent or distant

tissues. Third immobilization of the reconstructed auricle to the side of the head at the correct angle must be attained. The pitfalls in solving these difficulties are discussed.

The report of a problem in partial reconstruction of the auricle in a patient with marked hypertrichiasis is presented. As the hypertrichiasis precluded the use of the usual donor sites for soft tissue coverage, resort was made to the skin of the medial surface of the remaining auricle and the skin over the mastoid area was used to form a tubed pedicle flap later to become the helix. Cartilage for support was implanted under a postauricular flap. Following this the posterior surface of the postauricular flap was skin grafted to form normal auriculocephalic angle. The tubed pedicle flap was then utilized to form the helix.

Excellent photographs and diagrammatic sketches clearly indicate the various operative steps (eight) which were completed in 3 months.

CARL H. KLABUNDY, M.D.

Observations on an Absorbable Powder to Replace Talc. E. L. MACQUIDDY and J. P. TOLLMAN. *Surgery* 94:8, 3, 786

The use of talc as a lubricant on gloves in surgery has been questioned for the past 10 years. Several authors have called attention to the dangers of talc as a factor in the production of adhesions and of talc granulomas. Difficulty has been encountered in finding an acceptable substitute for talc.

Talc or soapstone was found in the incinerated lung of a woman supposedly dying from tuberculosis, who had worked for some years in the handling of products made from soapstone.

Since 1919 there have appeared various articles describing a condition found particularly in the peritoneum resembling tuberculosis but which was recognized as not being a true tuberculous lesion. It was described as pseudotuberculosis.

Work has been done on absorbable starch powder. It consists of a mixture of amylose and amylopectins derived from cornstarch which has been treated by physical and chemical means to improve its lubricating value and to prevent gelatinization when autoclaved.

The first portion of investigation was an allergenic study to determine whether human beings could have

become previously sensitized to this or similar starches. It was also attempted by means of parenteral injections to sensitize animals.

The second section of the study consisted of injecting starch powder intraperitoneally and subcutaneously in rabbits and guinea pigs, and intraperitoneally alone in dogs to observe its effect. These particular experiments were also contrasted with similar experiments on animals using talc. The talc experiments were carried out to confirm previously reported work on the use of this powder.

The third portion of the study consisted of inhalation experiments in which rabbits were exposed to atmospheres of talc and of starch powder under the same conditions.

Studies were made to determine existence of a previously acquired sensitivity to this starch. Patch tests were made on 50 adult males. The tests were applied and left in place for 72 hours with readings recorded at the end of 24, 48, and 72 hours. No positive reactions were obtained.

An extract was made of this starch in the manner used to prepare allergens for use in the allergy department. Eighty-one patients with allergenic backgrounds in the allergy clinic at the University of Nebraska were tested both by scratch and by intracutaneous tests. No reactions were found in this group. In so far as the results were concerned no previous sensitivity to this starch could be found.

No sensitivity to this starch was found in the group of human beings tested.

There was nothing to prove that the animals became sensitive when injected parenterally with this absorbable powder.

No peritoneal adhesions occurred in any of the animals in which starch powder was used.

The work showed that a chemically modified starch powder when placed in the tissue of animals, is nonirritating and is readily absorbed from the peritoneal cavity.

The work confirms that of previous authors that talc is irritating when placed in the peritoneal cavity of dogs and rabbits, and in the lungs of rabbits.

The evidence indicates that starch powder is a safe replacement for talc for surgical and other purposes for which this commodity is widely used.

HARRY W. FINE, M.D.

# PHYSICO-CHEMICAL METHODS IN SURGERY

## ROENTGENOLOGY

Cerebral Angiography JOHN R. GREEN and ROMAN ARAMA. *Am J Roentg* 1948 59 617

The authors give a brief summary of the history of cerebral angiography and state that in America the method is used rarely for the diagnosis of cerebral neoplasms.

**Angiographic anatomy.** Two pairs of arterial trunks bring blood to the brain. The two carotid arteries and their branches supply the frontal parietal and lateral portion of the temporal lobes the anterior half of the thalamus and the corpus striatum. The two vertebral arteries and their branches supply the caudal region of the brain including the inferior portions of the temporal lobes occipital lobes posterior part of the thalamus brain stem and cerebellum. The distribution of the entire arterial system of the brain is described in great detail. Normal arteriograms obtained by the carotid and vertebral injections as well as diagrams are used for illustration.

The venous system of the brain is also considered. The venous channels are divided and considered as superficial cerebral veins deep cerebral veins and dural sinuses.

**Circulation time.** It takes approximately 4 seconds for the blood to pass from the carotid artery into the dural sinuses. The arterial phase lasts one second and the capillary phase is usually complete within 4 to 5 seconds after the injection of the opaque medium. By proper timing it is possible to visualize any of the phases roentgenographically. When the external carotid is visualized simultaneously and in injection of the vertebral system the rate of flow is a few seconds slower. Likewise increased intracranial pressure certain neoplasms, aneurysms and vascular occlusions often slow down the circulation time.

**Techniques.** Cerebral angiography can be done by direct injection of the internal carotid or vertebral arteries, or by injection of their tributaries namely, the common carotid and subclavian arteries respectively.

During the past 5 years angiographic studies were made at the Illinois Neuropsychiatric Institute by over 10 different operators and teams. The percutaneous method of injection was preferred this giving satisfactory information in 71 per cent of the cases. The authors believe that with experience a good operating team should attain close to a 100 per cent result. The cases in which the percutaneous method fails are subjected to surgical exposure of the artery. Sodium pentothal anesthesia by intravenous drip is used. Routine endotracheal intubation serves as a precaution against the possibility of laryngeal spasm during manipulation of the neck although it is not essential.

TABLE I —CLINICAL ANALYSIS OF 107 ANGIOGRAPHIC EXAMINATIONS

	No cases
1 Diseases of Blood Vessels	
a. Saccular arterial aneurysms	11
b. Malformations and tumors	
1. Arterial angiomas	2
2. Venous angioma (Sturge-Weber)	1
3. Linder's disease	1
c. Occlusions	
1. Traumatic	1
2. Embolic	1
3. Eclampsic	1
Total	18
2 Neoplasms	
a. Meningiomas	7
b. Sarcoma of meninges	2
c. Gliomas	
1. Astrocytomas	4
2. Glioblastoma multiforme	28
3. Miscellaneous	
Subependymal plate	1
Third ventricle	1
d. Cancer metastases	7
e. Unverified tumors of the brain	8
Total	58
3 Miscellaneous Conditions	
a. Subdural hematomas	1
b. Brain abscess	1
c. Others	3
Total	5
4 Normal Angiograms	26

The authors give a detailed description of the injection technique as well as of the roentgenologic technique.

**Contrast substances.** The most commonly used opaque media for cerebral angiography are (1) thorotrast, (2) diodrast, (3) perabrodil and (4) ethyl triiodine stearate. The relative merits of each is discussed. Only the first two substances are being used in American clinics. The authors prefer diodrast since, in contradistinction to thorotrast it is completely excreted and has no potential danger from radioactivity. Allergic reactions may occur with it but a preliminary sublingual test applied routinely would put one on guard. The injection of the diodrast is painful and therefore a general anesthesia is required.

**Material.** The authors publish their observations on 107 cases of cerebral angiography. There was not a single mortality and a transient allergic reaction was noted in only 6 instances. The distribution of the cases is shown in Table I.

**Diseases of blood vessels.** Cerebral angiography offers a most specific method of diagnosis in this group of entities. In the authors series saccular aneurysms comprised the majority of the vascular



anomalies. They usually were (1) congenital (2) arteriosclerotic, and (3) mycotic in origin. In most cases, it was possible to visualize the exact site, size, and anatomic relationship of the aneurysms. This knowledge is of invaluable aid to the operator in planning whether to merely ligate the internal carotid artery in the neck or to resort to an intracranial intervention. It must be pointed out that in some instances although the clinical diagnosis of aneurysm seemed to be certain, the angiogram remained negative. This can happen when the neck of the aneurysm is too small to receive the contrast substance or if the aneurysm is filled with hematoma. In such cases the neurosurgeon must proceed without the aid of angiography.

**Neoplasms.** The most important angiographic alterations in neoplasms are (1) displacement of normal vessels, (2) pathological changes within the blood vessels of certain tumors, and (3) dilatation of vessels supplying a tumor i.e., meningiomas. Therefore angiography offers, in addition to the exact localization of the neoplasm, the possibility of a histopathologic evaluation of the type of tumor.

The authors series includes 58 cases with neoplasms. In the majority there was evidence of increased intracranial pressure at the time of examination. Angiography did not lead to aggravation of the symptoms or signs in a single case, so that the method is less dangerous than ventriculography.

The angiographic pattern is discussed in detail for (1) meningiomas (2) gliomas, comprising the two important subgroups of (a) glioblastoma multiforme and (b) astrocytoma and (3) cancer metastases. The glioblastoma multiforme was diagnosed in 22 out of 28 verified cases and the cancer metastases in 3 out of 7 verified cases.

**Indications and contraindications.** Angiography is contraindicated in acute cerebrovascular hemorrhages, thromboses, or emboli and is hazardous in old patients with cardiac decompensation, hypertension, and advanced atherosclerosis. In suspected brain abscess and chronic subdural hematoma it should be used only after other diagnostic methods have failed.

Air studies are preferred for the localization of obscure lesions of the ventricular system, of the posterior fossa and those above the tentorium in which lateralizing signs are absent. On the other hand, angiography is the method of choice in aneurysms, vascular malformations, parasellar lesions, and in supratentorial pathology if lateralizing findings are present.

The authors give the case histories of 15 patients and use the respective roentgenograms for illustration. A bibliography of 60 articles is appended.

T. LEUCOTIA, M.D.

**Plain Radiography of the Skull in the Diagnosis of Intracranial Tumors.** DAVID STEINBOCK. *Brit. J. Radiol.*, 1943, 287

The author presents an analysis of the pertinent radiological findings in plain films of the skull in 200

verified cases of intracranial tumor at the Kilmara Hospital, Stirlingshire, Scotland. In 22 per cent of the cases radiographic signs of increased intracranial tension were indicated by diastasis of sutures, increased convolutional markings or thinning or erosion of the dorsum sellae. Increased convolutional markings were accepted as of significance but only with caution, the group included only 4 cases—3 children who also showed diastasis of sutures, and 1 adult with a cerebellar astrocytoma in whom the calvarium had a distinct beaten silver appearance. Localizing signs were found in 30 per cent of the patients in the form of shift of the calcified pineal, abnormal intracranial calcification, bone erosion, new bone formation, and occasional spectacular widening of vascular channels so pronounced as to fall outside the limit of normal variation. While each sign was indicative of lesion, it was of course recognized that they were not in themselves pathognomonic of tumor.

Sellar changes were found of value in localization only if in the form of uniform expansion of the sella. The most frequent sellar changes were thinning or erosion of the dorsum, but these were common both to tumors in or near the sella and to those at a distance from it (metasellar lesions). The degree of sellar destruction and the degree of hydrocephalus were found roughly proportional to each other in metasellar lesions, but there was no satisfactory evidence that the hydrocephalus itself was the cause of the bone destruction. The possibility is offered that at least a contributory cause of such sellar changes may be the finding. In some cases, of dilated anterior end of the third ventricle in contact with the sella.

Abnormal intracranial calcifications (and ossifications) were, of course, of definite help in localization and occurred in 7 per cent of the cases, composing a group of meningiomas, astrocytomas, suprasellar cysts and godendroglioma, a dermoid and a hemangioma, and including 4 osteomas. The attachment of the latter to the base of the skull and their homogeneous and very marked density with lobulated periphery made them recognizable radiographically as osteomas, and the dermoid could also be diagnosed from the roentgenogram because a tooth was visualized. Otherwise the author found the position and pattern of solitary intracranial calcification not dependable as an indication of the pathological nature of the lesion—not even as to whether it was a tumor. All 3 instances of suprasellar calcification in this group occurred in craniopharyngiomas, but on reviewing the literature the author found that Dale in 1934 had reported suprasellar calcification in a chiasmata glioma and in a suprasellar meningioma.

Shift of the calcified pineal laterally or in the sagittal plane may be a valuable sign in localization. In this series 32 calcified pineals were visible in anteroposterior projection and of these 13 showed a lateral shift. In each case the tumor was found to lie in the hemisphere opposite to the direction of shift. No shift is to be expected in cases of tumor situated in the posterior fossa, in very small cerebral tumors in

multiple tumors evenly divided in mass between the cerebral hemispheres or in small supratentorial midline tumors. Shift of the calcified pineal in the sagittal plane was shown in 15 cases. All were supratentorial, and in each the shift was away from the tumor. Of these in 5 cases a lateral shift was also shown so that not only could it be told which hemisphere was involved but roughly which half of it.

Extracerebral tumors have a common capacity subject to radiographic record that of bone erosion. Among such tumors in this study were those of the pituitary a chordoma some acoustic neurinomas and several meningiomas especially those of the base. New bone formation on the other hand was stimulated only by 2 meningiomas located near the midline of the vault and although rather characteristic in appearance was known to have been initiated by lesions of other origin such as osteoplastic metastases primary sarcoma hemangioma and osseous fibrosis.

LILLIAN DOVALDSOY M.D.

#### Radiology in Heart Surgery T. HOLMES SELLORS. *Brit J Radiol.*, 1948 21 226.

The author, a thoracic surgeon emphasizes the importance of accurate diagnosis in the advancement of cardiac surgery and the need for teamwork between the physician the radiologist and the surgeon. He believes that comprehensive roentgen examination not only in the standard positions should be carried out but that careful fluoroscopy kymography and angiocardiography are important.

Two main groups of heart disease of primary interest to the surgeon are discussed (1) certain forms of congenital disease such as patent ductus arteriosus coarctation of the aorta anomalies of the aortic arch and great vessels and Fallot's tetralogy, and (2) cardiac compression causing pericardial abnormalities pericardial effusions polyserositis, and constrictive pericarditis.

The author presents briefly the surgical possibilities and the differential diagnostic criteria in these conditions with emphasis on the roentgenological aspects.

The article is accompanied by good reproductions of representative diagnostic films with several kymographs.

ALLAN K. BRINLEY M.D.

#### A Simplified Method of Roentgen Pelviccephalometry ANGUS K. WILSON *Am. J. Roentg.* 1948 59 688.

Accurate roentgen measurements of the fetal skull is difficult. For the past 4 years the author has employed a method which permits accurate cephalometry in both vertex and breech presentations. The author reports his experience with the use of this method.

Since, in the majority of cases the fetal skull lies in the maternal midline and in a reasonably sagittal or lateral plane it is possible to determine the height of the skull above the film and to make corrections for distortion due to magnification thus actually calculating the desired skull dimensions. An antero-

posterior and a lateral view (at right angles to each other) is used with the patient recumbent. Knowing the target film distance and the distance from the midline of the patient to the film the height of the fetal skull above the anteroposterior view and one or more of its diameters as well as the heights of the maternal pelvic planes can be calculated.

In the case of vertex presentation four films are made. If there is a breech presentation one or two more films centered on the fetal skull are added. The films are (1) a film in a semi-erect view with the patient sitting at an angle of 45 to 55 degrees and the tube centered opposite the anterior superior iliac spine to show the pelvic shape (2) a standard anteroposterior film to which in case of breech presentation a second 10 by 12 inch film is added centered over the skull at the higher level (3) a lateral film made immediately after the former so as not to disturb the relative positions with the patient moved to the side of the table directly against the cassette and the tube turned horizontally supplemented by a second film if there is a breech presentation and (4) another lateral film made with the patient erect in a true lateral view so that the femoral heads are superimposed the tube being centered as in film 3 midway between the symphysis pubis and the anterior superior spine of the ilium.

The distance from the target to the film is 40 inches. Film 3 serves to determine the heights of the fetal skull and pelvic planes. When making this film the technician also measures the distance from the midline of the patient to the surface of the wafer grid adding 1 cm. which is the distance from the surface of the grid to the film within the cassette. When film 4 is made the distance from the patient's midline to the table top is measured and to it 4.0 cm. are added, corresponding to the distance from the surface of the table to the film within the cassette in the Bucky tray.

The positioning of the patient for all four films is illustrated and the resulting roentgenograms are reproduced.

The calculations are based on the following mathematical formula.

$$\frac{\text{Tube to film distance}}{(\text{Tube to film distance}) - (\text{Object to film distance})} = \frac{\text{roentgen image diameter}}{\text{original diameter}}$$

For convenience the author constructed a false centimeter scale based on the 40 inch target film distance which is similar to that developed by Walton based on a 30 inch distance. The scale is reproduced and its use explained. As has been stated film 1 serves only to ascertain the pelvic shape. The measurements are made, in respective order on films 3, 2 and 4. The calculations and necessary corrections are described in detail.

The method has the advantage of technical simplicity with ease of calculation and evaluation of the results. The only measurements required of the technician are from the midline of the patient to

fired surfaces. The calculations can be made on wet films if need be.

This report is based on an experience gained in over 200 examinations. T. LUCOTTA, M.D.

**On Irradiation Sickness.** KAI STELLI and PIERRE ERMALA. *Ann. chir. gyn. fem.*, 948, 37 Supp. 1.

During the past decade irradiation sickness has become a problem of considerable magnitude. It is impossible to predict who will develop radiation sickness. It may appear after the administration of 200, 600 or 1,000 roentgens. Symptoms, although variable, are manifested by nausea, lassitude, anorexia, vomiting, oliguria, cramps, bloody diarrhea, low blood pressure, restlessness and prostration.

Several theories have been offered as a cause of radiation sickness: gases produced in the x-ray room; the electric field surrounding the patient; vitamin B deficiency; irradiation effects of endocrine glands; destruction of intestinal mucosa; nervous factors; histamine (histaminelike) substance; and changes in the blood cholesterol contents. Of all the theories mentioned the only ones that are still supported by some authorities are the histaminelike substance and changes in blood cholesterol.

The effect of 300 roentgen irradiation on lipids showed a 60 per cent decrease in blood cholesterol and an increase of 28 per cent of the liver cholesterol. The effect was more pronounced when the dosage was raised from 300 to 1,000 roentgens.

A group of 65 adult patients was used in the present study. A determination of the chylomicron count, which is more rapid and reliable than the usual methods of chemical analysis, was made. Chylomicrons are formed of lipids and are surrounded by a protective protein layer; the average size is  $5 \times 10^{-6}$  cm. and there are 80,000,000 chylomicrons per cubic centimeter of blood.

All forms of roentgen therapy were used; the dosage varying from 500 roentgens for cancer of the larynx to 350 roentgens for gynecological cancer. A 5 gm. radium pack was used to give a 732 roentgen surface dose.

All parts of the body and different types of carcinoma were studied for the chylomicron count. Of 21 patients with head lesions treated, only 2 showed evidence of irradiation sickness; in these 2 patients the carotid sinus area was irradiated. Of 16 patients with neck lesions the carotid area was irradiated in 15 patients; of these 9 developed irradiation sickness. The chylomicron curves in all cases were depressed. Of 3 patients with lesions of the thorax and 2 with lesions of the extremities, none developed irradiation sickness. Of 23 patients with carcinoma of the abdomen, 5 showed evidence of irradiation sickness with typical lowering of chylomicron count. It was also noted that in some instances of prolonged irradiation the chylomicron count would tend to become lower even if the patient showed no clinical evidence of irradiation sickness. Not once was a low chylomicron count observed in a well patient.

On the basis of their studies the authors conclude that patients suffering from irradiation sickness show marked changes in the chylomicronograph. Irradiation to the lower cervical region (carotid sinus), midabdomen or pelvis produced evidence of sickness.

A daily dose exceeding 350 roentgens, if treatment were continued, would produce sickness also, an increase in the daily dose or a larger dose would show the same results. In some instances changes in the chylomicronograph were evident before the clinical symptoms.

Facts tend to support the theory that irradiation produces injurious effects which are carried from the tissue by way of the circulation. This substance is histaminelike in character. In addition, involvement of the sympathetic and parasympathetic nervous system which controls the chemical composition of the blood may be a factor.

MAURICE D. SACHS, M.D.

**A New Medication for Radiation Sickness** (Une nouvelle médication du mal des rayons). H. KRITZER. *Presse med.*, 948, 56, 370.

Radiation sickness with its well known symptoms, such as loss of appetite, fatigue, nausea, and vomiting, is a relatively frequent complication of roentgenotherapy occurring particularly in patients treated for pelvic or thoracic affections. Different factors have been incriminated in explaining the cause of the symptoms: the presence of ozone in the treatment room; chemical changes in the organism; absorption of substances produced by the destruction of cells, particularly histamine; sympathetic or parasympathetic disequilibrium; injury of the suprarenal glands; and psychologic factors. None of these theories has given a satisfactory explanation.

Stig Kulander, after having analyzed the degree of acidity of the vomitus of 54 patients suffering from radiation sickness, found total achlorhydria in 50 and a very low degree of acidity in the 4 others. He then gave these patients a 7 per cent solution of hydrochloric acid immediately after the symptoms subsided and disappeared in the majority of cases.

The author states that he had occasion to treat 20 patients with hydrochloric acid. These patients had been treated for uterine tumor and presented a variable degree of radiation sickness. Forty-eight hours after the hydrochloric acid was given, the vomiting stopped, the nausea was attenuated, and the appetite became normal. In some cases, a state of nausea persisted but it was not serious enough to prevent the patient from eating.

The dose prescribed is as follows: 7 per cent official hydrochloric acid, from 20 to 40 drops in water before the principal meals. In certain cases with severe alimentary intolerance it is advisable to prescribe a supplementary dose of 40 drops immediately before the treatment.

In mild cases, with only nausea but no vomiting, adrenalin, vitamin PP, and parasympathicomimetics are often sufficient for attenuating the symp-

toms. However, in severe cases with digestive intolerance and dehydration and in which discontinuation of the treatment is considered it seems that hydrochloric acid by mouth gives more effective results than any other ordinary medication used up to the present time

MARC K. P. SIO M.D.

### MISCELLANEOUS

**The Effect of Radiation on Hemopoiesis. Is There an Indirect Effect?** JOHN S. LAWRENCE, WILLIAM N. VALKOTINE, and ANDREW H. DOWDY. *Blood* 1948 3 593

The controversial and poorly understood problem of the presence or absence of an indirect action of roentgen rays is again investigated. This relates especially to tissues that are far removed from the site of the irradiated ones. In a review of the literature upon the subject the authors cite much evidence for and against such an effect and conclude that "it is readily apparent that the literature weighs heavily on neither side of the question."

Twenty-six successful cross circulation experiments using cats are presented. Normal animals were connected to irradiated animals in two groups: (1) shielded groups of animals whose partners were connected at the time of irradiation, and (2) those whose partners were cross circulated with a previously irradiated animal. The cross circulation required from 3 to 10 hours lasting 8 hours in the largest group. The total leucocyte and absolute lymphocyte counts were followed for 28 days.

The authors were unable to demonstrate any specific effect due to the radiation alone. They offer three possible explanations for the differences of opinion expressed by others. First the indirect action may be due to the inclusion of larger amounts of hematopoietic tissue than those generally considered. This may be especially true in debilitated patients who have lost some of the ability to supply additional reserve cells, also the exact amount of tissue irradiated is not known in many cases. Second a specific indirect effect may still exist even though these experiments do not support such a contention. Third a nonspecific effect of the radiation may occur because of injury to tissue irradiated with the liberation of a circulating toxic substance. The substantial reduction in lymphoid tissue not directly injured has been well substantiated and frequently observed as a response to a variety of injurious agents. This is well shown by striking degenerative and involutionary changes in all lymphatic organs as a response to a variety of insults as described by Selye and called the alarm reaction by him. Such insults include cold heat surgical shock, and drugs. Radiation's indirect action may be another insult of this nature.

ROY GREENING M.D.

**Some Hematologic Effects of Irradiation** WILLIAM BLOOM and LEON O. JACOBSON. *Blood* 1948, 3 586

Two main types of study were carried out: (1) total body irradiation and (2) focal irradiation.

In the first case rabbits, mice, rats, and guinea pigs were exposed to total body irradiation with roentgen rays and gamma rays and slow and fast neutrons. The LD 50/30 days dose of each agent was used and gradually decreased until no histologic or hematologic changes were observed.

Focal irradiation was administered to a few mice through external sources using  $P_{25}$ , but largely through intravenous, intraperitoneal or intramuscular infection and inhalation of  $P_{25}$  and several other isotopes including both alpha and gamma emitters. The LD 50/30 days dose and diminishing fractions thereof were used.

In addition daily exposure with gamma and roentgen rays over periods up to 3 years was carried out.

The authors observed no evidence in the blood forming tissues and in the peripheral blood of a primary stimulation of hematopoiesis. An increase in circulating heterophil-leukocytes occurred within 24 hours with doses up to and beyond LD 50/30 days of total body irradiation, an observation previously reported by other investigators. The authors attribute this to a reaction to injury mediated through a mobilization rather than to the formation of new blood cells.

The changes noted on histologic examination were the same regardless of the type of irradiation used.

The spleens in the mice exposed to large amounts of beta rays in the focal irradiation experiments showed zones of radiation damage merging gradually with normal spleen. There was no zone of hyperplasia of undamaged cells at the periphery of the zone of radiation damage. Since beta rays have a limited range of penetration the authors point out that near the periphery of the range the small amount of radiation would evoke a stimulation if such an effect occurred.

In the authors' experience external and internal ionizing radiation failed to produce evidence of primary stimulation in the blood-forming tissues and peripheral blood.

PAUL R. NOBLE, M.D.

**The Value of Platelet Counts in Radiotherapy** W. M. COURT BROWN. *Brit J Radiol* 1948 21 321

The increasing use of wide field roentgen therapy necessitates a more reliable indicator of the constitutional effects resulting from excessive irradiation of the bone marrow.

Red and white cell counts have previously been used as indicators during treatment, but in spite of these controls some patients have suffered from a temporary or permanent marrow failure at a later date.

Noting that skin hemorrhages similar to thrombocytopenic purpura often appeared just before severe anemia in cases of wide field irradiation the author investigated the effect of radiation on the platelet count as an indicator.

It was found that wide field radiation produces a fall in the blood platelet level which may be paralleled by the white cell count, but not always so. In

many cases the white cell count after an initial fall shows a tendency to rise and this rise may be maintained in spite of the continuance of treatment, being most marked in the leucemias. With more restricted forms of radiation in which a high local dose was given over bone similar platelet count drops were observed.

Following irradiation platelet counts continue to fall for a variable period returning to normal within month if the level at cessation of treatment was above 100,000 platelets per cubic millimeter.

In a series of over 100 cases it has been found that with the use of 200,000 platelets per cubic millimeter as the low limit of normal and 100,000 platelets per cubic millimeter as the lower limit of safety constitutional effects from excessive irradiation of the hemopoietic system have been completely avoided, and that adequate dosage has been administered.

Wide-field irradiation is not given to any patient with an initial platelet count below 100,000 per cubic millimeter and treatment is terminated when this level is reached.

Although textbooks state a platelet level below 40,000 per cubic millimeter is usually associated with purpuric manifestations, levels of roentgen ray-induced thrombocytopenia of the order of 15,000 to 20,000 platelets per cubic millimeter have been observed without petechial hemorrhages. In those cases with petechiae the time interval over which the petechiae appeared was very much shorter than the time interval over which the platelet level remained critically depressed. Some other factor besides thrombocytopenia is postulated for the production of petechial hemorrhages and several theories are advanced. The possible effects of roentgen irradiation on the prothrombin level are now being investigated.

ALLAN K. BROWN, M.D.

Complementary Postoperative Radiotherapy for Breast Cancer (Radioterapia post-operatoria complementare del cancro della mammella). GIACCARLO PERLASCA. *Tumori*, Milano, 1947 33: 212.

The value of postoperative roentgentherapy has always been in doubt therefore the author made a study of the results obtained in the patients undergoing surgery alone and compared them with those obtained in patients undergoing surgery followed by irradiation.

The patients with carcinoma of the breast were classified according to the method advocated by Steinfeld. Those in the first stage had a small, isolated, movable tumor with no palpable glands and no metastases. Those in the second stage had a larger tumor with attachment to the skin and the pectoral muscle, palpable lymph glands and metastases to these glands (verified by microscopic examination). Those in the third stage presented clinical metastases with involvement of the supraclavicular glands.

The percentage of cure of patients with breast tumors in the first stage after 3 or 4 years was the same, whether or not they had received postoperative radiotherapy.

For those in the second stage, nothing was more helpful than removal followed by radiotherapy to get rid of the residual neoplastic tissue. One must not forget that x ray therapy is local and there are times when diffusion has already taken place and any spread is not affected by roentgen therapy. This explains the fact why some people die of metastases although the local lesion has been destroyed.

For patients in the third stage the use of postoperative roentgen therapy is only palliative as it only decreases pain and prolongs life.

ARTHUR F. CIRIOIA, M.D.

## MISCELLANEOUS

### CLINICAL ENTITIES—GENERAL PHYSIOLOGICAL CONDITIONS

**Vitamin C Requirement of Human Adults: Experimental Study of Vitamin C Deprivation in Man.** R. A. PETERS, K. H. COWARD II A. KREBS L. W. MARSH AND OTHERS. *Lancet* Lond. 1948 1: 853.

There is no agreement on the requirement of vitamin C in man. All are rough estimates and range from 30 mgm or less to 75 mgm.

This paper attempts to assess the daily requirements in human volunteers. There were 19 men and 1 woman between the ages of 21 to 34 years. They lived a normal life without strenuous physical work. Scurvy developed in all on the deprivation diet after 35 weeks apparent by the numerous hemorrhagic follicles on the legs by the gum changes by the redness and lividness of the scars and by the reduced tendency of the recent scars of incision to heal. Other tests revealed no significant findings.

The response to 10 mgm doses of vitamin C daily followed a general pattern. Hemorrhages ceased within a month wound tissues healed within 2 months but the gums required from 10 to 14 weeks for complete healing. The concentration of vitamin C in the plasma and white blood cells showed a small but distinct rise after 101 days.

Judged by the criteria available a dose of 10 mgm. of vitamin C daily was sufficient to maintain the normal healing power of the skin up to 12 months. In the nonsupplemented group severe defects in wound healing occurred similar to those recorded in scorbutic guinea pigs. These defects were encountered only when and not before clinical signs of scurvy had appeared. STEPHEN A. ZIEMAN, M.D.

**Thrombin and Delayed Thrombin: Modifiers of the Coagulation Time (La thrombine et la thrombino-rétard: modificateurs du temps de coagulation).** MICHEL DECHAUME, GEORGES CRUT and MICHEL GOUDART. *Press méd* 1948 55: 317.

The parenteral use of thrombin appears to be at least as important as its local application. It increases greatly the hemostatic capacities of the patient. Intravenous injections of 75 units of thrombin mixed with glycochol which acts as a buffer substance are well tolerated; they decrease the coagulation time in direct ratio to its original state. This mixture is called medical thrombin. The addition of a 5 per cent solution of magnesium hyposulfate to the medical thrombin reinforces its efficacy and makes its action less rapid but more prolonged, the reaction is such as to justify the term 'delayed thrombin'.

The authors have used intravenous injections of thrombin to prepare a hemophilic patient for dental extractions. They observed the following facts.

1. Two hours after an injection of medical thrombin the coagulation time fell from 360 minutes to 20 minutes.

2. The coagulation time then rose slowly but did not reach its original state 24 hours after the injection.

3. It was possible to lower the coagulation time by giving daily injections.

4. By adding a 5 per cent solution of magnesium hyposulfate to the medical thrombin any danger of coagulation in the syringe was avoided and the risk of sending an embolus into the general circulation was eliminated.

5. This combination of drugs did not reach its maximal effect before 8 hours had elapsed since the injection.

6. With this delayed thrombin the average coagulation time was less than that obtained with 7 times more medical thrombin. These facts were confirmed by observations in 2 other patients whose coagulation time was 25 and 30 minutes respectively.

The authors have injected up to 300 units of medical thrombin in a day and believe that the intravenous administrations should be reserved for severe cases. In average cases 150 units may be given orally on the eve and on the morning of the intervention in more serious cases intramuscular injections may be used.

Medical thrombin which acts quickly should be regarded as an emergency therapeutic measure capable of arresting the hemorrhagic accidents of any subject whose blood coagulates poorly. Delayed thrombin seems to get quite near to the ideal treatment of hemophilia. It is not yet what insulin is to diabetes but judging from the results obtained it is well on the way to becoming just as efficient.

RICHARD KEMEL, M.D.

**Pathologic Studies in Secondary Shock (Pathologisch-anatomische Untersuchungen über den Wundchock).** LAURI KALAGA. *Acta Soc med Duodecim* 1947 24: 30.

The author refers to the paucity of reports of histological studies in secondary shock. It is true that there have been extensive studies in animals subjected to experimental shock but these do not necessarily reflect the changes seen in human beings. The author was unable to find complete studies with careful histological analysis of any large series of patients who had succumbed to shock. With the casualties attending war and the large number of high speed traffic accidents, the author undertook such a study in a series of 9 patients who had died presumably of shock. These patients had died at varying periods, from 5.5 hours to 4 days, following the trauma. The autopsies were performed very soon after death and all of the parenchymatous organs, the hollow viscera, and the skin, subcutaneous tissue and muscles were subjected to careful gross and histologic scrutiny.



**The Parathyroid: a Study Based in Part on 60 Postmortem Examinations with Presentation of a Case of Hyperfunctioning Adenoma** HACK U STEPHENSON JR. WILLIAM L. MCNAMARA, and BURRILL GOLDBERG *Am J M Sc* 1948 215 381

All of our knowledge of the parathyroid is relatively recent, since that organ was first recognized as an independent structure in 1880 and since it was not until 1902 that the first case of parathyroid tumor was reported. In this article the authors review the history of the diseases of this important gland and discuss its embryology anatomy histology and pathological physiology. In connection with the histology material is presented from the studies of 60 postmortem specimens.

The hormone secreted by the parathyroid glands acts largely upon calcium and phosphorus metabolism, apparently regulating the level of calcium ions in the blood. Hyperfunction produces typical disturbances most notable in the bones. There is some disagreement as to the manner in which these changes are effected. Collip and others believe that the hormone acts specifically on bone causing proliferation of osteoclasts and in turn resorption of bone and possibly formation of giant cell tumors. Excessive quantities of calcium and phosphorus are freed from the skeleton and carried in the blood to the kidneys and intestine. The resulting hypercalcemia and increased urinary calcium and phosphorus are logical consequences but the diminution of the inorganic phosphorus content of the blood is not clearly understood. On the other hand Albright contends that excessive parathyroid hormone acts primarily on phosphate metabolism lowering the renal threshold for phosphorus and increasing thereby the amount excreted in the urine. There is a consequent decrease of phosphate ions in the serum resulting in unsaturation of the blood with calcium phosphate and leading ultimately to liberation of the calcium phosphate of the bones. Such a view not completely confirmed by all investigations would make the parathyroid influence on calcium metabolism and on bone secondary to its regulation of phosphorus metabolism.

The diseases of the parathyroid are classified as primary states secondary states and neoplasms. Of the primary states it may be said that diffuse hyperplasia with hyperfunction is very rare so too is atrophy of the gland with hypofunction. In secondary parathyroid disorders there may be hyperfunction of the gland as a compensatory reaction to those conditions in which chronic renal insufficiency exists, with phosphate retention and chronic acidosis. There may be similar secondary hyperparathyroidism in diseases which deplete the available body calcium such as rickets or multiple myeloma. Secondary hypofunction sometimes accompanied by tetany occurs following extensive thyroidectomies in which parathyroid tissue has been excised or injured. The third category of parathyroid disease—neoplasms—consists almost entirely of adenomas as truly malignant tumors are exceedingly rare. Up to January, 1947 there had been 337 cases of adenoma reported.

Those tumors which consist of oxyphil cells do not produce hyperfunction.

The classical symptoms and findings of osteitis fibrosa cystica and the more elusive manifestations of less severe hyperfunction are discussed. Four case reports are included. One of these deals at some length with a case of hyperfunctioning adenoma, the other 3 are concerned with other parathyroid disorders.

BENJAMIN F. LOUNSBURY M.D.

**Myxoma, the Tumor of Primitive Mesenchyma** ARTHUR PURDY STOUT *Ann Surg* 1948, 137 706

The author defines myxoma as a true neoplasm composed of stellate cells set in a loose mucoid stroma through which course very delicate reticulin fibers in various directions. It resembles primitive mesenchyme and there are no recognizable differentiated elements. Growth is progressive and is both expansive and infiltrative. The tumor does not metastasize and if it kills it is because of damage to vital structures through compression or erosion. The author has found that it occurs about equally in males and females and in all ages from birth to old age with greatest frequency in the fifth decade. Anatomically, it occurs most frequently in the heart but it is also found in the skin and soft parts bones and genitourinary system. The fingers are most frequently involved when it is found in the skin the mandible and maxilla are the most frequent bone sites and most of the genitourinary cases present involvement of the bladder.

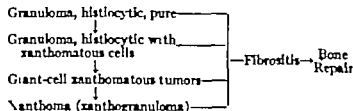
While the tumors are usually small a tumor weighing over 5 kgm. was removed from the retroperitoneal space.

Röntgen ray therapy has not proved to be successful and because of the infiltrative nature of these tumors limited excision of the apparent growth has resulted in recurrences.

DANIEL RUCK, M.D.

**A Proposition Concerning the So-called Xanthomatous Type of Giant Cell Tumors** (A proposito de la llamada variedad xantomatosa de los tumores gigantocelulares) F. SCHAJOWITZ and S. MONDOLFO *Rev ortop traumat B. Air.* 1947 17 34

Giant cell tumors according to Ewing, are divided into xanthomatous xanthomatous, telangiectatic, and those arising from cartilage. Evidence is produced in this article showing that the xanthomatous type of giant cell tumor is hyperplastic, belonging to the histiocytic bone granulomas. The authors consider the evolution of the tumor as follows:



For these reasons the tumor should be called xanthomatous histiocytic granuloma or xanthogranuloma.





SURGERY  
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It is not possible to differentiate these tumors by roentgenography they are however histologically distinct. Because of their granulomatous origin they are benign and their prognosis is good following conservative treatment which consists of curettement and filling the defect with bone chips. Postoperative radiotherapy is not necessary if curettement is thorough.

STEPHEN A. ZIEGLER, M.D.

### EXPERIMENTAL SURGERY

Renal Transplantation; Anastomosis with Non-metallic Prostheses (Transplantation rénale anastomotique par prothèse non métallique) JACQUET (Report *Presse méd.* 1949, 58 319).

In his experiments on dogs, Oudot found that the best way to preserve the kidney between its removal and grafting was to immerse its vessels only in serum at 5° C. and to place the organ on a wet compress in closed glass. He heparinized the donor to prevent coagulation and made the anastomosis to the external iliac vein armed with nonmetallic prosthetic tube. Cutaneous ureterostomy is impractical because the animal tears off everything it can reach and the zone of implantation soon suppurates. It is therefore necessary to take recourse to ureteral reimplantation without vesical patching.

The factors which contribute to the success of renal transplantation include the choice of young material, the quality of the venous anastomosis (especially without torsion), reduction of the size of the external iliac artery by placing a catgut suture on it that is moderately tightened, fixation and position of the kidney in the iliac fossa without angulation of the vessels, heparinization, avoidance of pressure on the ureter, conservation of the longitudinal ureteral vessel, and avoidance of infection.

Oudot reports his results. In homogeneous grafts cutaneous ureterostomy is an easy operation, but the kidney stops functioning after 10 days, gradually the rate of urea and chloride decreases and histologic examination shows a suppurative necrosis which changes the aspect of the organ completely. Ascending infection is the cause of the changes. In ureterostomy the problem is complicated by the ureteral factor.

It is necessary to wait for about a month to learn whether the graft is functioning or not. Only after the 2 normal kidneys have been removed is it possible to know whether the operation has succeeded and a one kidney is grafted at a time this means that the animal must be submitted to four operations. This makes it a difficult experiment which often ends with a uræmic animal. If extreme care is not taken the kidney becomes infarcted and the lesions predominate in the medulla. On the other hand, there is often a calcareous deposit in the epithelial cells of the tubules. The only animal that Oudot followed up until its death had had a double graft of homogeneous kidneys with vesical patching. It survived only 12 days but the volume of urine remained high for 4 days with a good concentration of urea and chloride. Autopsy revealed anastomoses without thrombosis and hydronephrotic and slightly infarcted kidneys with obstructed ureters.

In autogenous grafts results were excellent provided that the kidney was normal from the beginning; it seems that the grafted kidney resumes its function only in the presence of a normal kidney. Afterward the normal kidney can be removed in its turn and replaced on the iliac vessels. Oudot now has several animals which are living and in excellent condition on two transplanted kidneys.

ROBERT KATZ, M.D.

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